ASSET MANAGEMENT PLAN

FOR CORE ASSETS

CITY OF CORNWALL | 2022

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Appendix

DEFINITIONS

Asset

An item, thing or entity that has potential or actual value to an organization. The value can be tangible or intangible, financial or non-financial, and includes consideration of risks and liabilities.

Asset Category

A category of municipal infrastructure assets that is an aggregate of assets.

Asset Hierarchy

A logical digital index of assets and asset information.

Asset Management (AM)

Planned actions and coordinated activities of an organization to optimally and sustainably manage its assets that will enable the assets to provide the desired level of service in a sustainable way, while managing the risk at the lowest life-cycle cost. It encompasses all asset types, tangible or intangible, individual components or complex systems, and all activities involved in the asset's lifecycle from acquisition/creation, through maintenance to renewal or disposition.

Asset Management Plan (AMP)

A strategic document (long-term) that states how a group of assets is to be managed over a period of time. The plan describes the characteristics and condition of infrastructure assets, the levels of service expected from them, planned actions to ensure the assets are providing the expected level of service, and financial strategies to implement the planned actions.

Asset Management Policy

Mandated requirements, overall intentions/principles and framework for control of asset management. An Asset Management Policy guides the overall direction of the asset management system, providing direction to the appropriate focus and level of asset management practice expected. It shall establish key principles, overall vision for the program, and align other municipal plans.

Asset Management Strategy

Documents the intended approach by which the assets and other resources will be used to achieve the agreed upon objectives within the agreed Policy framework. It provides clear direction, intentions and rationale. It also identifies the organizational readiness, including identification of barriers and appropriate implementation plans to overcome the barriers.

Building Together – Guide for Municipal Asset Management Plans

A document, released by the Government of Ontario, which explains the importance and the feature s of an AMP. It is organized into four (4) main parts:

- Part 1: Context;
- Part 2: Asset Management Planning;
- Part 3: The elements of a detailed AMP; and,
- Part 4: Conclusion.

Capital Asset Threshold

The value of the infrastructure asset at or above which an organization will capitalize the asset's value and below which the organization will expense the asset's value.

Community (Customer) Levels of Service (LOS)

Community Levels of Service (also known as Customer Levels of Service) measures are typically expressed in non-technical terms and describe the general public's understanding of services being provided by infrastructure systems. Community LOS measures are typically related to the service that is provided by the overall system supporting the service delivery, rather than the specific assets.

Core Asset

Includes any municipal infrastructure asset that is a:

- water asset that relates to the collection, production, treatment, storage, supply or distribution of drinking water;
- wastewater asset that relates to the collection, transmission, treatment or disposal of wastewater, including any wastewater asset that from time to time manages stormwater;
- stormwater management asset that relates to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater;
- road; or,
- bridge or culvert.

Current Replacement Value

The amount that an entity would have to pay to replace an asset at the present time, according to its current worth.

Deterioration Curve

A mathematical representation of the change in condition of an asset over time. These curves can be plotted on a graph, with the x-axis representing time (age), and the y-axis representing condition values (or ratings).

Estimated Service Life (ESL)

For new assets, this is the estimated expected life (usually in years) that an asset will function, assuming typical general maintenance is carried out. Typically, ESLs vary for different types of assets, such as a concrete culvert vs. a corrugated steel pipe.

Infrastructure

The physical structures and associated facilities that form the foundation of development, and by or through which a public service is provided.

Infrastructure Deficit

A spending shortfall in comparison to an established need. This can include the accumulated deficit that results year over year due to financial shortfalls.

Key Performance Indicator (KPI)

A quantifiable measure used to evaluate the success of an organization, employee, asset, etc. in meeting objectives for performance.

Level of Service (LOS)

The parameters or combination of parameters that reflect the social, political, economic, and environmental outcomes the organization delivers. Level of service statements describe the outputs or objectives of the organization's activities that are intended to be delivered to the community.

Lifecycle

The useful life of an asset from acquisition to disposal, typically expressed in years.

Lifecycle Activity

Activities undertaken with respect to an infrastructure asset over its service life, including constructing, maintaining, renewing, operating, and decommissioning, and all engineering and design work associated with those activities.

Lifecycle Cost

The total cost of ownership over the life of an asset. This may include but is not limited to capital costs, operating costs, maintenance costs, renewal costs, replacement costs, environmental costs, and user delay.

Lifecycle Management Strategy

The set of planned actions that will enable the assets to provide the desired levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost.

Long-Term Financial Plan

A plan that projects a forecast of financial performance and position over a period of at least five years. The Long-Term Financial Plan should be consistent with actions required to implement strategies proposed in other plans/documents.

Maintenance

Activities that allow assets meet their required performance objectives, including regularly scheduled inspection and maintenance and activities associated with unexpected or unplanned events.

Non-infrastructure Lifecycle Activities

Actions or policies that are not capital in nature, which result in the lowering of costs and/or extend the useful life of an asset.

Ontario Regulation O.Reg. 588/17

Under the Infrastructure for Jobs and Prosperity Act, 2015, principles are set out by the provincial government to regulate asset management planning for municipalities. On December 27, 2017, O. Reg. 588/17 was released which regulates asset management planning for municipal infrastructure.

Preventive Maintenance

Regular, routine or regularly scheduled maintenance activities that are intended to keep assets in good working order and prevent or minimize unplanned failures or downtime.

Public

Residents and businesses in the City of Cornwall, stakeholders, or other interested parties.

Rehabilitation

Significant repairs designed to extend the life of an asset. Rehabilitations are often

Remaining Useful Life

Time left (usually in years) in the asset before it is considered failed, usually related to an anticipated failure mode.

Risk Management Strategy

The City's Risk Management Strategy details the methodology and framework used to assess for the City's asset portfolio. It details the methodology and results used to assign Probability of Failure, Consequence of Failure and Risk Ratings to the City's assets, which assists the City in understanding asset criticality, and prioritizing assets for rehabilitation or replacement.

Technical Levels of Service (LOS)

Technical LOS are technical measures applied against assets and overall systems that define the performance requirements to support Community Levels of Service and are used to determine which criteria will be used to drive business decisions. Technical LOS are often expressed in quantitative or numerical terms.

1. EXECUTIVE SUMMARY

1.1. INTRODUCTION

The City of Cornwall's 2022 Core Asset Management Plan (AMP) provides the City's plan to responsibly manage the majority of its core assets. The City's core assets include a portfolio of over $1.5 Billion of infrastructure assets that provide utilities (water, wastewater, and stormwater) and transportation services (road network and active transportation).

The scope of this AMP includes assets across the City's utilities and transportation service areas. The assets included within the scope are provided in Figure ES 1 and Figure ES 2.

Figure ES 1: List of in-scope Assets (Asset Hierarchy) – Utilities

Figure ES 2: List of in-scope Assets (Asset Hierarchy) – Transportation Services

The structure of this AMP is based on the Province of Ontario Guide: Building Together – Guide for Municipal Asset Management Plans. In line with that guideline, the AMP contains the following major sections (for each asset class).

1. **State of Infrastructure:** details information on the current asset valuations, inventories, condition, age and estimated service life, supported by asset data. Data sources, confidence and assumptions are also provided.
2. **Levels of Service (LOS):** details the measures and key performance indicators (KPIs) that the City tracks to ensure it is providing adequate service to the community. LOS are subdivided into Community LOS and Technical LOS.
3. **Lifecycle Management Strategy:** details the lifecycle activities that the City undertakes to maintain its assets in a state of good repair and meet its service

level objectives. This section also details costs associated with funding the lifecycle periods over both 10 and 25-year forecast periods.

4. **Growth Considerations:** details the City's approach to accommodating growth and its associated impacts.
5. **Financial Strategy:** provides a financial analysis on the costs required for the City to meet service level objectives, backlogs in asset-related capital needs, full lifecycle costing of assets, and strategies to address shortfalls/backlogs and maintain service levels.
6. **Improvement Plan:** provides recommendations the City can undertake to continually improve the data, systems, and processes that support the future continued improvement of this AMP.

1.2. STATE OF THE INFRASTRUCTURE

The City's asset register is a collection of asset data from multiple sources, stored in a centralized location. This database provides the information needed to report on the state of the infrastructure. The definitions of condition categories are provided in Table ES 1.

Table ES 1: Overall Condition Rating Scale

Category	Description	Example Life Consumed	Example Condition Rating
Very Good	▪ Asset is typically new or recently rehabilitated.	0% to 25%	1
Good	▪ Condition is acceptable, generally in mid stage of service life. Asset may show preliminary signs of deterioration requiring attention or minor maintenance.	25% to 50%	2
Fair	▪ Assets show general signs of deterioration that require attention and may require immediate maintenance.	50% to 75%	3
Poor	▪ Asset is below standard condition and approaching the end of its service life. Ongoing monitoring and significant maintenance may be required.	75% to 100%	4
Very Poor	▪ Asset is at or beyond service life and shows signs of advanced deterioration. Asset may exhibit signs of imminent failure that can affect service or increase risk. Condition may be critical. Extensive monitoring, rehabilitation and/or replacement may be required.	>100%	5

Utilities

Generally, the City's Utilities assets are in Good condition. A summary of the replacement value and overall condition of Utilities assets is provided in Figure ES 3 and Figure ES 4.

Although the majority of these assets are in Good condition, expenditures are required for lifecycle strategies to address Poor and Very Poor assets, prevent other assets from reaching Poor condition and maintaining service levels

		Replacement Value	Condition
	Sanitary Sewer Collection System	$233.41M	Very Good
	Combined Sewer Collection System	$196.98M	Good
	Storm Sewer Collection System	$207.50M	Good
	Water Distribution Network	$345.87M	Fair
	Utilities Total	$983.76M	

Figure ES 3 Utilities Overall Condition and Replacement Value Summary

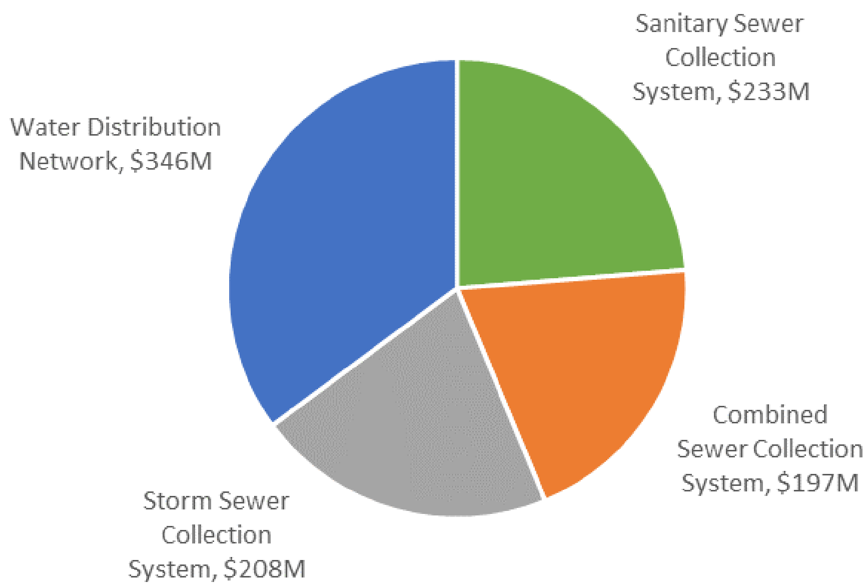

Figure ES 4: Utilities Valuation Summary

A visualization of the installation year of the City's Utilities assets by asset class is provided in Figure ES 5. Note that it is evident from this figure that the City had experienced a construction boom in the 1960s and 1970s. This is largely due to the Ontario Water Resources Commission projects that took place at that time. Refer to individual State of the Infrastructure figures on each asset class for more details.

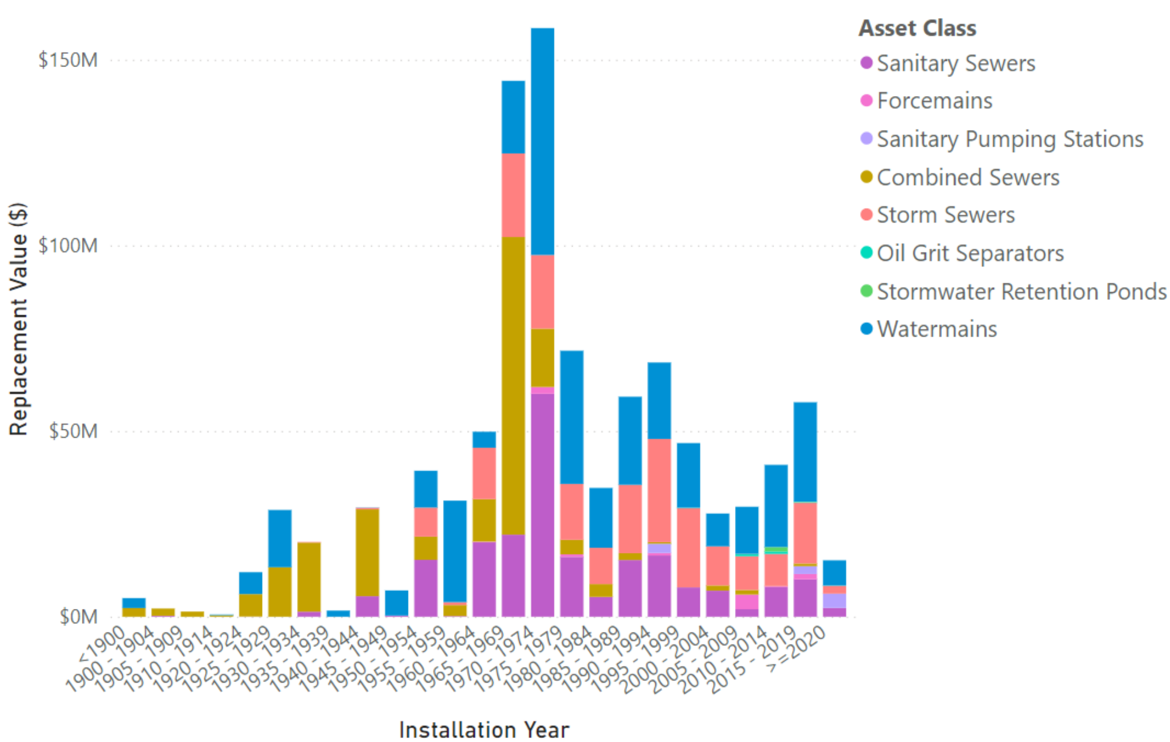

Figure ES 5: Utilities Construction Date Distribution

A visualization of the condition distribution of the City's Utilities assets, by asset class is provided in Figure ES 6.

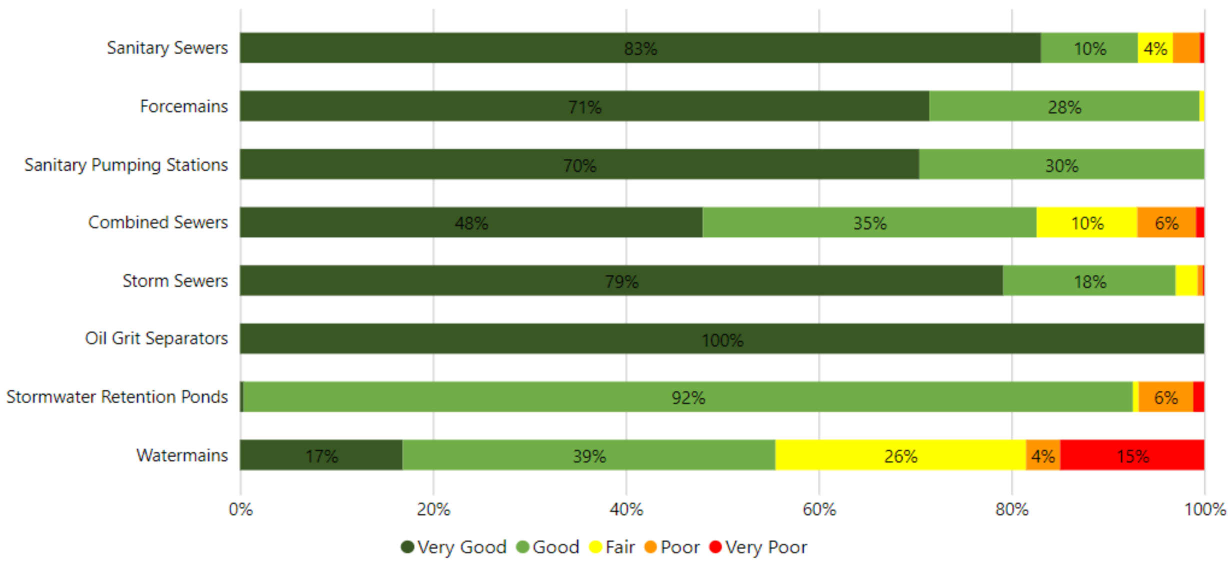

Figure ES 6: Utilities Condition Distribution by Replacement Value

Transportation Services

Generally, the City's Transportation Services assets are in Fair to Good condition. A summary of the replacement value and overall condition of Transportation assets is provided in Figure ES 7 and Figure ES 8.

Although the majority of these assets are in Fair to Good condition, expenditures are required for lifecycle strategies to address Poor and Very Poor assets, prevent other assets from reaching Poor condition and maintaining service levels.

	Replacement Value	Condition
Road Network	$535.62M	Fair
Active Transportation	$47.29M	Good
Transportation Total	$582.91M	

Figure ES 7 Transportation Overall Condition and Replacement Value Summary

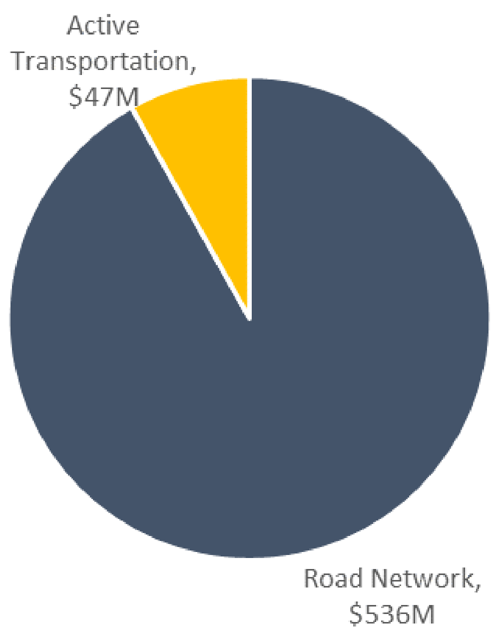

Figure ES 8: Transportation Valuation Summary

A visualization of the installation year of the City's Transportation Services assets, by asset class is provided in Figure ES 9.

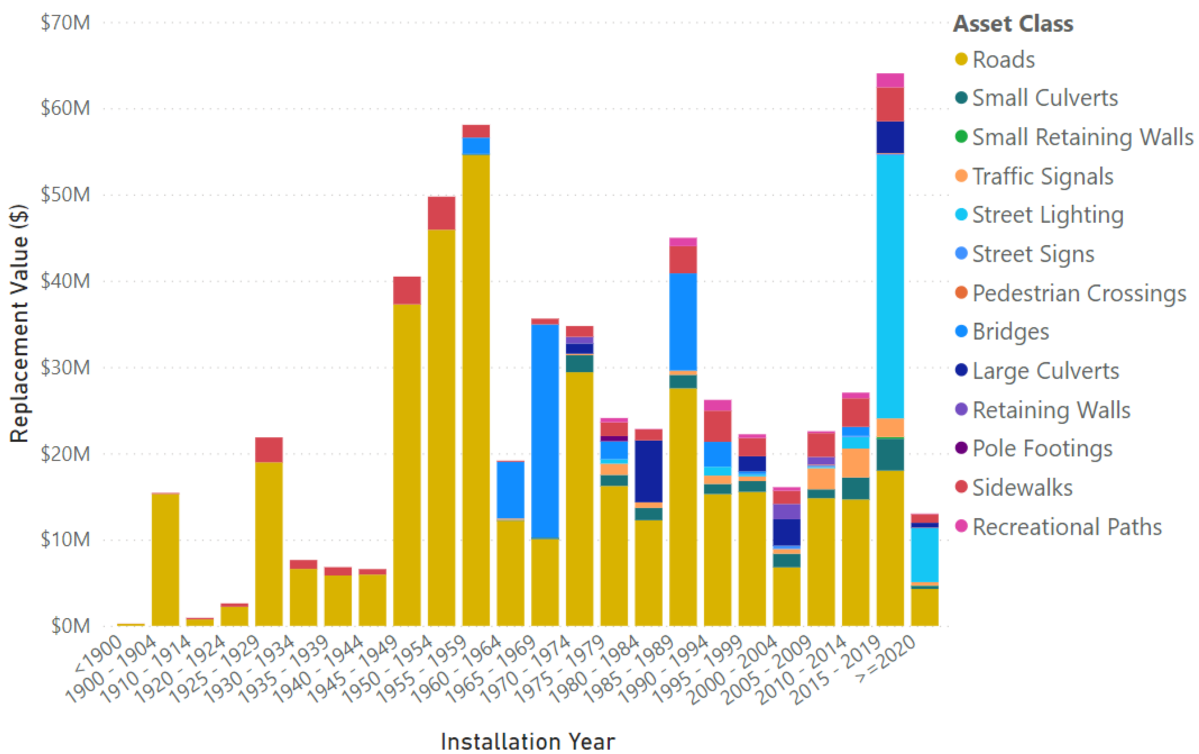

Figure ES 9: Transportation Services Construction Date Distribution

A visualization of the condition distribution of the City's Transportation Services assets, by asset class is provided in Figure ES 10.

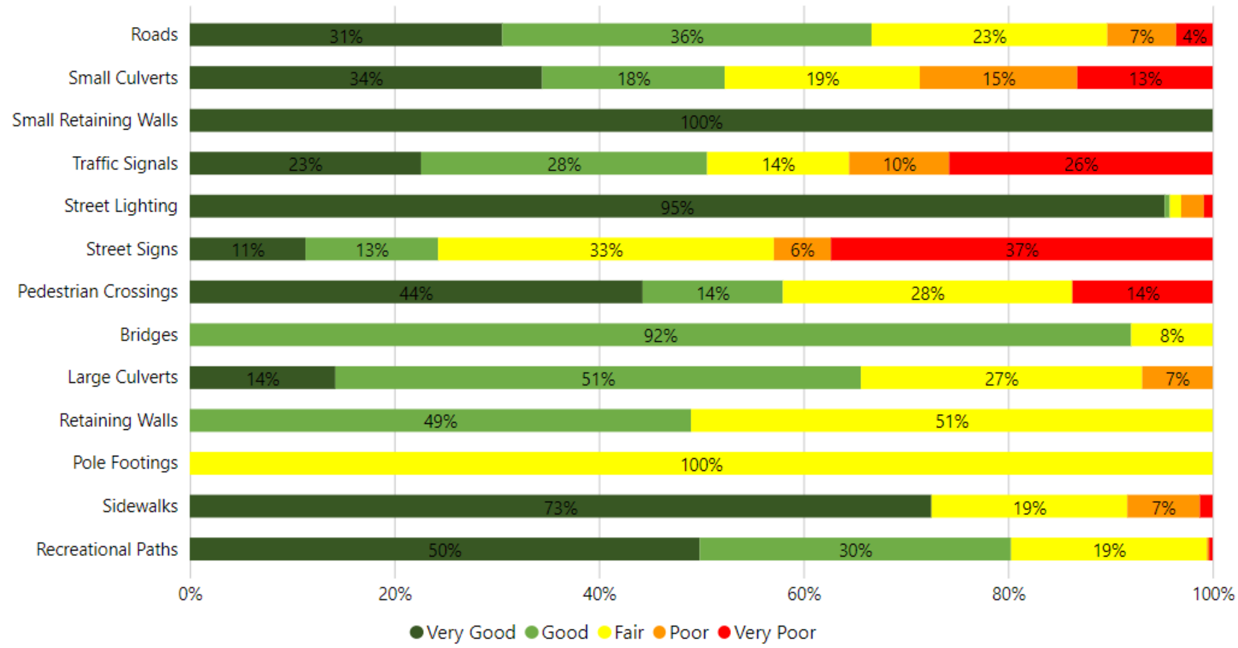

Figure ES 10: Transportation System Condition Distribution by Replacement Value

1.3. LEVELS OF SERVICE

Throughout the City's AM journey, and in past AMPs, it has continued to establish, monitor and achieve LOS that guide its asset management program. This AMP represents the next step to advance the maturity of the City's LOS framework. It includes the implementation of the City's first LOS strategy and framework in alignment with O.Reg. 588/17.

Levels of Service (LOS) are a measure of the degree to which an asset meets functional or user requirements. Typically, LOS are measured in terms of parameters that reflect social, political, environmental, and economic outcomes that an organization delivers. The LOS are organized into key service attributes that describe the service (for example reliable, quality and safe).

The LOS subsections within each chapter of this AMP document the established LOS indicators for each service. These LOS include a set of measures that are prescribed by O. Reg. 588/17, as well as LOS measures that were established by the City. The City's LOS framework is presented in two tables within this AMP: the Community LOS Table and the Technical LOS Table. Each of these tables follow a slightly different structure but contain common elements that link them together. The LOS are further explained in Section 2.5.2.

The City has established 39 Community performance measures, and 61 technical performance measures which make up its LOS framework. These measures are developed around the key attributes of the service that each asset class provides. Select LOS from the City's framework is provided in Table ES 2. These are the condition-based LOS that the City has established for its assets. The following table lists key reliability LOS measures for each asset class, related to the condition of each asset. The full suite of LOS measures is provided in the body of this AMP, including the measures required by O.Reg. 588/17 as well as additional measures defined by the City.

Table ES 2: Select Techncial Levels of Service

Subservice	Performance Measure	Current Performance
Sanitary Sewer Collection System	Percentage of sanitary sewers that are in fair or better condition	97%
	Percentage of forcemains that are in fair or better condition	100%
	Percentage of sanitary pumping station condition assessment recommendations that have been completed	100%
Combined Sewer Collection System	Percentage of combined sewers that are in fair or better condition	93%
Storm Sewer Collection System	Percentage of storm sewers that are in fair or better condition	99%
	Percentage of oil and grit separators that are not past their service life	100%
Water Distribution Network	Percentage of watermains in fair or better condition	82%
Road Network	Percentage of arterial roads in fair or better condition	86%
	Percentage of collector roads in fair or better condition	88%
	Percentage of local roads in fair or better condition	89%
	Percentage of small culverts that are not past their service life	87%
	Percentage of small retaining walls that are not past their service life	100%
	Percentage of traffic signals that are not past their service life	70%
	Percentage of streetlights that are not past their service life	97%

Subservice	Performance Measure	Current Performance
	Percentage of pedestrian crossings that are not past their service life	86%
	Percentage of street signs that are not past their service life	61%
	Percentage of bridges in fair or better condition	100%
	Percentage of large culverts in fair or better condition	93%
	Percentage of retaining walls in fair or better condition	100%
	Percentage of pole footings in fair or better condition	100%
Active Transportation	Percentage of sidewalks not past their service life[1]	99%
	Percentage of recreational paths not past their service life[1]	99%

1. Asset effective age is evaluated based on recorded condition ratings.

These LOS build on existing LOS that were defined separately within the City's past AMPs. The City has been working towards monitoring these values and setting targets to meet LOS. The following details the condition-based LOS measures and targets that the City strives to achieve:

- For the Sanitary Sewer Collection System, Combined Sewer Collection System and Storm Sewer Collection system (linear assets), the City's LOS measures are based on Pipeline Assessment Certification Program (PACP) ratings that consider the Structural Condition and Potential for Blockage from 1-5 with 1 being best and 5 representing failed infrastructure. A rating of 3 (Fair) or better was considered adequate. The City endeavors to repair or replace pipes with ratings of 4 or 5, for consistency with the methodology of the PACP User Guide and to ensure the systems are in a state of good repair. Therefore, its target is to ensure that 100% of pipes are maintained at a PACP rating of 3 (Fair) or better.
- The Sanitary Sewer Collection System (vertical) pumping stations LOS measures are based on ensuring that recommendations from condition assessments are completed. The City strives to ensure that 100% of recommendations are completed, to maintain its infrastructure in a state of good repair and avoid potential unplanned maintenance or failures of assets within pumping stations.
- For the Combined Sewer Collection System, in addition to the PACP-based LOS measure indicated above, the City endeavors to separate combined sewers as part of coordinated projects, to work towards a fully separated system, which will result in less backups and Combined Sewer Overflow (CSO) events.
- For the Storm Sewer Collection System (vertical), LOS measures are based on ensuring that 100% of assets do not exceed their service life. This will minimize

unplanned failures, which may result in potential flooding, backups or reactive maintenance works.

- The Water Distribution System LOS, is based on the watermain performance index (WPI) which measures service life for each material type with point deductions for break history and hydraulic performance[1]. Scores range from 0-100 with 100 representing a newly constructed pipe. Pipes rated below 20 are considered for replacement. The City endeavors to replace or structurally line(where appropriate) watermains that have a score of 20 or less, and maintain 100% of assets above this score (i.e. maintain assets in fair or better condition). This will result in a reduction of watermain breaks, and less unplanned or reactive maintenance/repair work.
- For Road Network (roads) assets, the City uses Pavement Condition Rating (PCR) scores, which are measured using an inventory observation process and assignment of PCR based on a City of Cornwall developed system. It is a 0-100 score with 100 representing a newly constructed road. The City has identified that areas of the road network are performing poorly. The City believes that improvement to its service levels would increase the performance of the system. Therefore its objective is to maintain 100% of roads assets in Fair or better condition, which equates to a PCR score of 50 and above (arterial and collector roads), or 45 and above (local roads). This will improve the condition of roads, minimize road defects such as potholes, and ensure roads are comfortable and convenient to drive on.
- For Road Network (retaining walls, small culverts, traffic signals, pedestrian crossings, streetlights, street signs), LOS measures are based ensuring that 100% of assets do not exceed their service life. This will minimize unplanned failures and reactive maintenance, which could cause an increase in traffic congestion or traffic incidents.
- For the Road Network (Municipal Structures), a Bridge Condition Index (BCI) rating is assigned to assets using regulated inspections and is a score from 0-100 with 100 being a newly constructed bridge or major culvert. The City endeavors to maintain 100% of bridges and culverts above a BCI rating of 50 (Fair) and Corrugated Steel Pipe (CSP) culverts above a BCI rating of 40 (Fair). Letting BCI values fall could result in potential bridge closures and emergency rehabilitation/reconstruction due to condition concerns.
- Active Transportation (sidewalks and recreational paths), visual inspections which are rated from 1 to 5, with a rating of 1 being best and 5 representing failed infrastructure. Assets rated as a 4 or 5 are considered for repairs. The City endeavors to maintain 100% of these assets to a rating of 3 (Fair) or better. This will minimize unplanned maintenance and possible pedestrian incidents such as slips, trips or falls.

[1] Sufficient fire flow is defined as having adequate pressure for firefighting needs as per the water model

1.4. LIFECYCLE MANAGEMENT STRATEGY

The City's Lifecycle Strategy is the set of planned actions performed on assets to provide LOS in a sustainable way, while managing risk, at the lowest lifecycle cost. This section of the AMP is composed of the following:

1. Descriptions of the specific lifecycle activities applied to each asset.
2. The forecasted lifecycle activity costs illustrating the capital and operational needs across the entire asset lifecycle from creation to disposal. Note that these costs are provided in a separate section for each subservice, entitled "Funding the Lifecycle Activities".

These lifecycle activities are important as they work together to extend the asset life, reduce overall lifecycle costs, and achieve other objectives such as environmental goals and balancing risk of asset failure. The asset lifecycle activities are detailed according to the categories provided in Table ES 3.

Table ES 3: Lifecycle Activity Categories and Descriptions

Lifecycle Activity Category	Description
Non-Infrastructure	▪ Activities that allow assets to meet current LOS requirements more efficiently
Operations and Maintenance	▪ Activities that allow assets meet their required LOS, including regularly scheduled inspection and maintenance and activities associated with unexpected or unplanned events.
Renewal/ Rehabilitation	▪ Significant repairs designed to extend the life of the asset.
Replacement	▪ Activities that are expected to occur once an asset has reached the end of its useful life and renewal/ rehabilitation is no longer an option.
Service Improvement	▪ Planned activities to improve an asset's capacity, quality, and system reliability.
Disposal	▪ Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed by the municipality. ▪ Costs are typically combined with rehabilitation or replacement activities.
Expansion	▪ Planned activities required to extend services to previously un-serviced areas - or expand services to meet growth demands.

The lifecycle models developed within the City's Lifecycle Strategy have been combined with the City's LOS and Risk Management strategies in a decision support system (DSS) model, which allows the City to run various forecasting scenarios. Additional details about the Risk Management Strategy are provided in **Appendix E**. The following scenarios were analyzed for each asset class:

- **Anticipated Budget** – Evaluates asset performance under the current budget that the City anticipates to allocate towards that asset class for a 10-year forecast period.
- **Cost to Maintain LOS** – Determines the cost to maintain LOS at current levels over a 10-year forecast period. This is a requirement of the July 1, 2022 milestone of O.Reg. 588/17.
- **Achieve Target LOS in 10-years** – Determines the cost and associated asset performance to achieve the City's target LOS over a 10-year forecast period. These targets generally apply to the reliability/condition based LOS that the City has established, which either include maintaining assets in a condition of fair or better, or ensuring assets do not exceed their service lives.
- **Achieve Target LOS in 25-years** – Determines the cost and associated asset performance to achieve the City's target LOS over a 25-year forecast period. This is the same target as described in the scenario above, but over a 25-year forecast period instead of a 10-year forecast period.
- **Backlog Analysis** – Evaluates the cost to address all asset needs, including existing backlog, assuming unlimited funding is available. This assists the City in understanding backlogs and future asset needs based on lifecycles.

The results of these scenarios helped inform the City's Financial Strategy. These scenarios provided analysis and insight on the City's spending needs with respect to asset renewals (i.e. rehabilitations, replacements and disposal). The Financial Strategy goes further, and includes costs associated with other lifecycle activities including non-infrastructure, operations and maintenance, service improvements and expansion. In addition to asset renewal, these costs are essential to sustaining and improving service levels and part of a holistic lifecycle focus.

1.5. FINANCIAL STRATEGY

The Financial Strategy puts the AMP into action. The Financial Strategy provides a way for municipalities to integrate asset management planning with financial budgeting.

The Financial Strategy forecasts the required annual expenditures for the City to perform the lifecycle activities in alignment with the lifecycle management strategies to maintain targeted LOS:

- Expansion activities;
- Non-infrastructure solutions;
- Renewal (rehabilitation and replacement) activities;
- Service Changes; and,
- Operations and Maintenance activities.

Each category includes the City's forecasted expenditures from its capital budget to understand the full cost of maintaining service levels over the 10-year forecast period. Lifecycle activities forecasts will be compared to the capital budget forecasts to determine if an infrastructure gap is present. Strategies to address this gap will also be discussed.

Results from the financial analysis are subdivided into three categories:

- **Wastewater:** Includes all linear and vertical wastewater and stormwater assets, excluding the Wastewater Treatment Plant.
- **Water:** Includes all watermain assets, does not include the Water Purification Plant, Reservoirs and Elevated Storage Tanks.
- **Taxation:** Includes all road network and active transportation assets.

The summaries of the financial strategy scenarios for the Wastewater, Water and Taxation categories are provided in Figure ES 11 to Figure ES 13.

Each graph illustrates the City's asset needs in a bar graph format. Bars illustrate costs associated with the abovementioned lifecycle activities. The equivalent annual cost of these bars is illustrated as a dashed line, labeled "Annual cost to Meet LOS in 10-years". The equivalent annual costs of the City's anticipated budget (solid blue line) from their financial forecast, as well as other analyzed scenarios (dashed lines) are also plotted to compare and contrast the scenario results. Gaps are visualized by the difference between the City's anticipated budget (solid blue line), and the various scenarios (dashed lines).

The figures also help to visualize the results of the various scenarios over the next 25 years. The bars illustrate the costs associated with the City's lifecycle strategies. The larger green-coloured bar illustrated in the year 2022 (i.e. first year of the graph) represents the City's backlog of renewal needs. The dashed lines represent the equivalent annual costs of various scenarios (i.e. the average annual cost of the renewal needs) of each scenario.

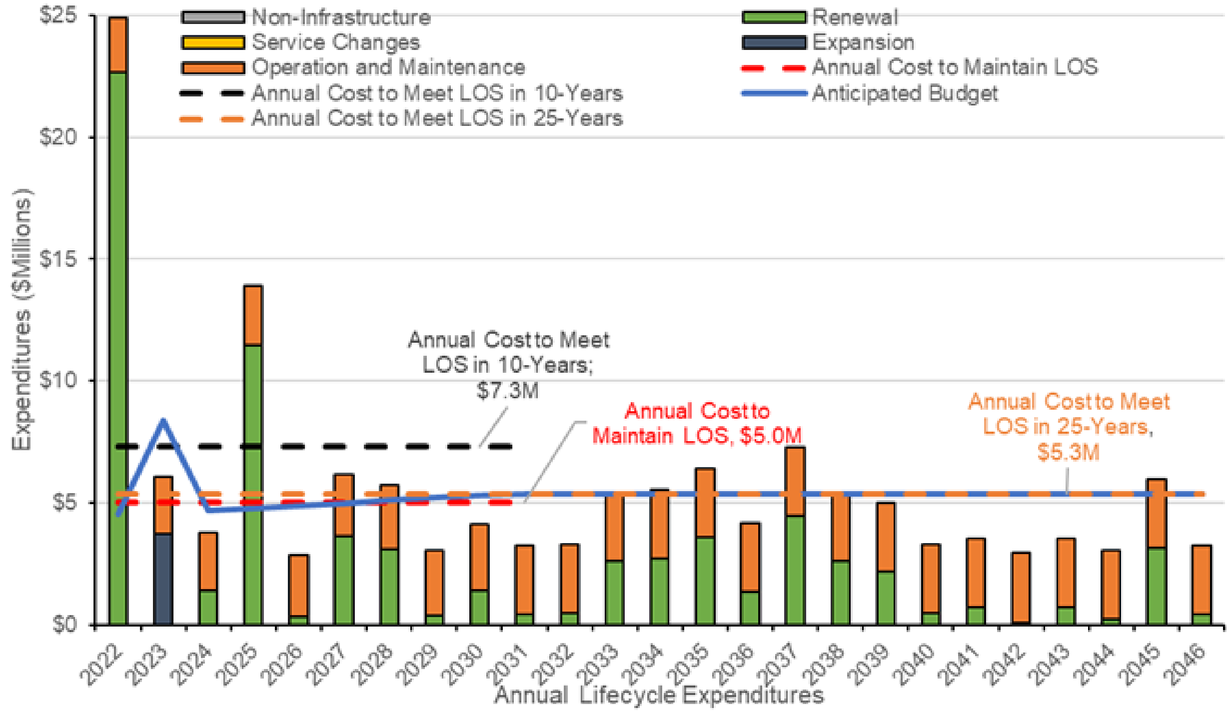

Figure ES 11: Financial Forecast Scenarios Summary – Wastewater

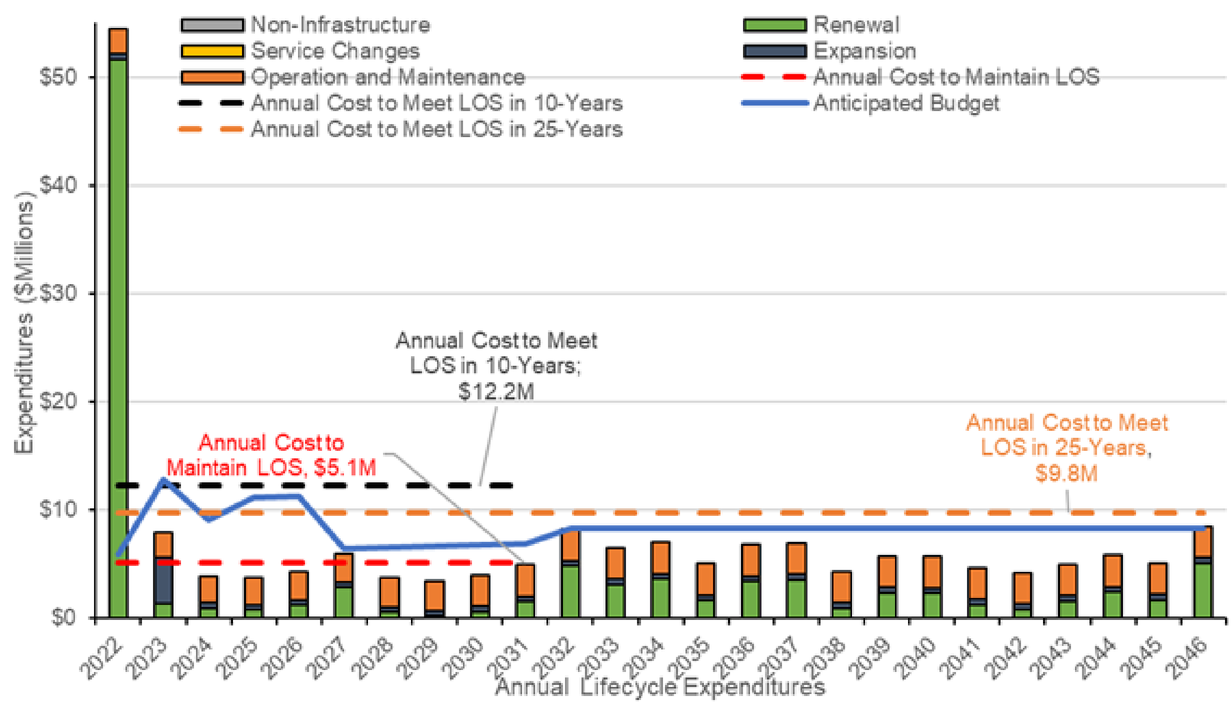

Figure ES 12: Financial Forecast Scenarios Summary – Water

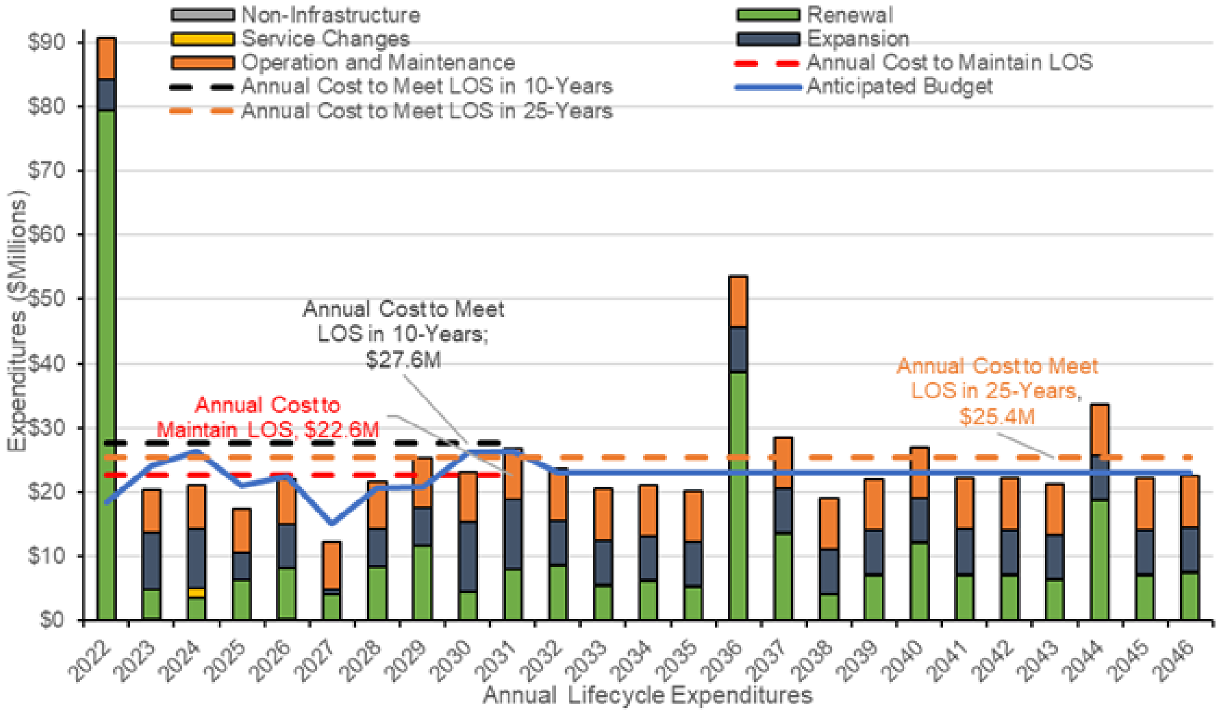

Figure ES 13: Financial Forecast Scenarios Summary – Taxation

These analyses have identified a total annual funding shortfall of **$1,667,500** for the wastewater category, **$3,851,500** for the water category; and **$5,510,170** for the taxation category if the City wants to achieve their target LOS in the next 10-years.

The same analysis was completed over a 25-year period, which has identified a total annual funding shortfall of **$0** for the wastewater category, **$1,408,400** for the water category; and **$3,060,263** for the taxation category.

Other strategies to address potential infrastructure funding shortfalls are to increase overall net spending to improve the performance of assets, or to adjust expectations of asset performance. There are several options to consider:

1. Modest increases to property taxation as well as water and wastewater rates above-baseline revenue increases to fund the infrastructure funding shortfall.
2. Seek funding from the Provincial or Federal governments to fund infrastructure. The City has been successful in securing grant funding in the past which has supported funding its backlog; however it is not typically provided for renewal of assets. The City is hopeful that its past successes in securing grant funding will continue into the future. In fact, the development of this AMP may have a positive impact in the City's ability to secure additional funding. Although grant funding will be helpful, it should not be relied upon by the City, since it is not guaranteed. However, it is typically not provided for the renewal of assets.

3. Draw from available reserves. A reserve analysis should be completed to identify the impact of this case. Reserves can assist in balancing shortfalls and excesses.
4. Consider debt financing. The City has included some anticipated future debt in its debt forecasts, however, beyond this, it generally attempts to avoid debt financing. This is not a preferred strategy, although the City recognizes that it is an option that may be utilized. The City continues to make progress towards funding only those one-time projects that are in excess of $2.5M as per the City's Long-Term Financial Plan.
5. Adjust asset performance expectations. Funding shortfalls may be reduced by revisiting stakeholder objectives against affordability/willingness to pay. This is particularly applicable to assets such as roads, which have shortfalls in the medium term that subside in the longer term.

1.6. IMPROVEMENT PLAN

Ontario Regulation 588/17 encourages municipalities to put an emphasis on a continuous improvement approach to asset management. Ensuring a living document requires monitoring and reporting on the implementation of asset plans to Council and staff.

The improvement plan provides commentary on each major section of the AMP, and details processes and actions that the City can undertake to continually improve the data, systems and processes that support this AMP, for future iterations.

The list of recommendations in the improvement plan are provided in Table ES 4.

Table ES 4: Improvement Plan Recommendations – Summary

Category	Recommendations
General Asset Management	▪ Expand the LOS, lifecycle management, and risk management strategies to other asset classes, including non-core assets.
	▪ Complete an assessment to understand the maturity of the organization’s asset management practices. This can be used as a monitoring tool to record continual improvement activities detailed within this improvement plan.
	▪ Complete climate change analysis to determine the potential effects on infrastructure, and possible strategies to ensure that the City continues to work towards meeting its service level objectives.
State of the Infrastructure	▪ Increase the City’s data maturity by collecting additional data to fill gaps, as identified in the City’s data gap assessment report (**Appendix A**).
	▪ Continue to collect and update asset data in line with the City’s Data and Condition Assessment Plan (**Appendix B**).

Category	Recommendations
	▪ Continue to complete condition assessments and collect asset condition data in line with the City's Data and Condition Assessment Plan (**Appendix B**).
Levels of Service	▪ Record LOS performance measures annually, to establish a historical compendium of LOS information to assist in refinement and improvement of the LOS strategy over time.
	▪ Continue to collect and update data to support future LOS measures that were identified in the City's LOS strategy, for which the City did not have available data to report on in this AMP (i.e. "advanced" or "future" LOS measures).
	▪ Review and revise the LOS framework annually to ensure that the LOS framework is up to date and best reflects the City's objectives and strategies.
	▪ Establish proposed levels of service, in line O.Reg. 588/17 requirements. Complete internal and community engagement to ensure that proposed LOS align with the needs of the City and community.
Lifecycle Management Strategy	▪ Continue to collect asset condition data, and use it to validate existing lifecycle models, modify existing lifecycle models or develop new lifecycle models.
	▪ Ensure that appropriate asset data is also collected and tied to the observed condition data, such as asset type, number of past asset interventions/rehabilitations, asset age, etc.
	▪ Wherever possible, develop lifecycle models based on a review of historical asset data, as opposed to professional judgment.
	▪ Continue to collect asset intervention costs digitally, and tie them to asset classes, to increase the maturity of forecasting costs.
Financial Strategy	▪ When developing the City's 10-year capital plan/forecast, ensure that project amounts are labelled by asset class (as per the City's Asset Hierarchy) and lifecycle activity type. This will simplify the exercise to complete the anticipated budget forecast scenario (i.e. Scenario 1 in this AMP) for future AMPs.

2. INTRODUCTION

The City of Cornwall (the City) is a single-tier municipality located on the north shore of the St. Lawrence River. The city has a total land area of 64 square kilometres, where the majority of its 47,845 residents live within a 20 square kilometre urban area.

The City's core infrastructure assets support the core services which the City provides for residents and businesses. These assets aid in providing Cornwall's citizens with a high quality of life by providing services that meet community values and expectations, in a financially and environmentally sustainable manner.

The City has an established Asset Management (AM) program which consists of AM practices and integrated processes that work together to manage the assets that provide core services. These processes are in place to balance the lifecycle activities that need to be performed on assets to ensure that the City provides a LOS that meets public expectation, while reducing risk at the lowest possible cost.

Throughout its AM journey, the City has taken steps to ensure that asset management planning is integrated with day-to-day operations and decision-making. This has resulted in the development of several AMP documents, including in 2006, 2014 and 2016.

In January 2018, the Province of Ontario enacted Ontario Regulation 588/17 Asset Management Planning for Municipal Infrastructure (O. Reg. 588/17). The regulation consists of guidelines and minimum requirements for municipal AMPs and policies in Ontario. In alignment with the regulation, in July 2019, the City adopted an Asset Management Policy that outlines the City's corporate commitment to the adoption of the asset management principles defined in the Infrastructure for Jobs and Prosperity Act, 2015. The Policy also illustrates how that in addition to the regulatory requirements, asset management is critical to support the City's Mission, Vision and Values.

To further advance the maturity of its AM program, the City has now issued this 2022 Core Asset Management Plan (AMP), in alignment with O.Reg. 588/17. This AMP provides the City's plan to responsibly manage the majority of its core assets – a portfolio of over $1.5 Billion of core assets that provide utilities (water, wastewater, and stormwater) and transportation services (road network and active transportation).

This 2022 Core AMP was developed through a collaborative effort amongst a range of individuals across the City within the following departments.

- The Department of Infrastructure and Municipal Works; and,
- The Department of Financial Services.

These staff members provided data, information, knowledge, and insight to support the analysis for this AMP.

2.1. OBJECTIVES

This AMP was developed in compliance with O. Reg. 588/17 and the City's 2019 AM Policy.

This AMP formally documents the state of infrastructure of core assets, LOS measures being tracked against each asset class, lifecycle strategies applied to the assets, and the funding and financial strategy required to balance LOS and reduce risk. This Plan links organizational objectives and the LOS needed to achieve them, the AM activities and processes performed to provide the intended LOS to the community and the cost of implementing those strategies.

2.2. PURPOSE

The purpose of this AMP is to:

- Ensure that the City responds to current AMP regulatory requirements.
- Provide recommendations to meet future AMP regulatory requirements.
- Support the line of sight between council approved plans and initiatives and asset investment needs.
- Establish an AMP Framework that can be expanded in the future to include additional service areas and asset classes.
- Report on the current state of the City's infrastructure assets.
- Describe current LOS.
- Detail the current lifecycle management strategies that the city undertakes to maintain assets and minimize the probability of asset failure and loss of service.
- Forecast expenditures required to sustain current LOS for the next 10 years and 25 years.
- Detail the City's financial strategy to sustain service levels through the management of its assets over the next 10 years and 25 years.
- Quantify the gap (if any) between planned spending and forecasted expenditures.
- Provide recommendations to continually improve the City's AM practices, and the development of future AMPs.

2.3. SCOPE

The City's 2022 AMP reports on the majority of its assets within the core asset categories, as defined by Ontario Regulation 588/17. The assets that are included within the scope of this AMP are provided in Figure 2-1 and Figure 2-2.

Figure 2-1: List of in-scope Assets (Asset Hierarchy) – Utilities

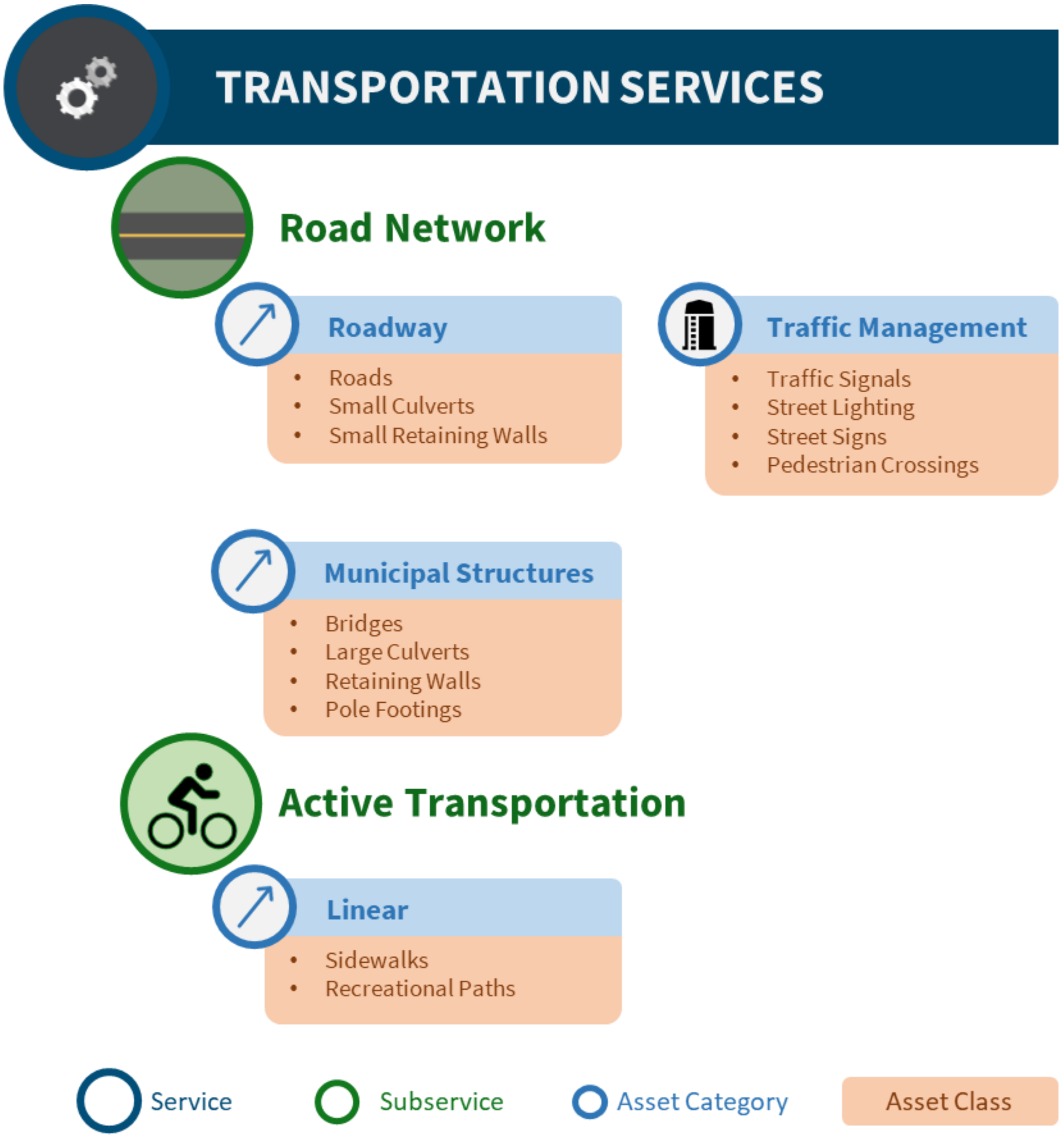

Figure 2-2: List of in-scope Assets (Asset Hierarchy) – Transportation Services

Note that this AMP does not apply to all of the City's core asset classes. The following asset classes are also owned by the City, and not included within this scope of this AMP. These assets will be covered in a separate AMP document issued by the City.

- Wastewater Treatment Plant
- Raw Water Intake Facilities
- Water Purification Plant
- Reservoirs
- Elevated Storage Tanks

2.4. TIMEFRAMES

This AMP covers planning forecast periods of 10 and 25 years. The City endeavors to review its AM practices and update this AMP at least once every five (5) years.

Note that due to the ongoing regulatory milestones of O. Reg. 588/17 (as detailed in Subsection 3.4), supplementary versions of this AMP are required to be developed for July 1, 2024 and July 1, 2025.

2.5. AMP OVERVIEW

The AMP is structured to provide consistency and ease of understanding for readers. The structure of this AMP is based on the guidelines of the Province of Ontario Guide: Building Together – Guide for Municipal Asset Management Plans. The scope of this AMP covers 22 different asset classes. As a result, this AMP document is organized into two key sections (one for each service area): Section 4 – Utilities; and, Section 5 – Transportation Services. Within each section, content is further categorized by subservice.

For each asset category the following subsections have been developed:

1. State of Infrastructure
2. Levels of Service
3. Lifecycle Management Strategy
4. Funding the Lifecycle Activities
5. Recommendations

Following these sections, the remaining sections of the AMP apply to all in-scope services/asset classes. These include:

6. Growth Considerations
7. Financial Strategy
8. Improvement Plan

The following subsections provide a summary of the objectives and content contained within each of these major AMP sections.

2.5.1 State of Infrastructure

The State of Infrastructure section includes the following information for each Subservice:

- A summary of the inventory of assets, by asset class, that support the subservice, including asset quantities.
- The total replacement value of each asset class.
- Asset age distribution and asset age as a proportion of estimated service life (ESL).
- An overview of current observed or predicted asset condition and how asset condition is assessed for each asset type.
- Data sources used, data confidence, data limitations, and all assumptions made to complete the state of local infrastructure analysis.

Condition ratings and categories were assigned to all assets across each service area using a standardized and common 5-point categorical rating scale. Where available, asset condition data was used to assign condition ratings. Since methods for determining asset condition vary amongst different asset classes, all existing condition scores were converted to the common 5-point categorical scale to prove a standardized and consistent basis for understanding asset condition This scale also allows for benchmarking of the results against the values provided within the AMP.

In cases where condition data was not available, the asset's consumed life (based on its age and ESL) was utilized to determine the condition categories. A sample methodology used to convert life consumed and condition ratings to the common 5-point scale is provided in Table 2-1. Similar tables are provided for each major asset class/grouping, to illustrate how condition ratings and asset age were converted to this standardized scale.

Table 2-1: Overall Condition Rating Scale

Category	Description	Example Life Consumed	Example Condition Rating
Very Good	▪ Asset is typically new or recently rehabilitated.	0% to 25%	1
Good	▪ Condition is acceptable, generally in mid stage of service life. Asset may show preliminary signs of deterioration requiring attention or minor maintenance.	25% to 50%	2
Fair	▪ Assets show general signs of deterioration that require attention and may require immediate maintenance.	50% to 75%	3
Poor	▪ Asset is below standard condition and approaching the end of its service life. Ongoing monitoring and significant maintenance may be required.	75% to 100%	4
Very Poor	▪ Asset is at or beyond service life and shows signs of advanced deterioration. Asset may exhibit signs of imminent failure that can affect service or increase risk. Condition may be critical. Extensive monitoring, rehabilitation and/or replacement may be required.	>100%	5

Data maturity and confidence was assessed as part of the state of infrastructure exercise. For each asset class, these assessments were made for key data fields required to support the AM analyses in this AMP including asset age, installation date, ESL, condition rating and replacement cost. Data was evaluated with respect to two (2) key evaluation metrics: completeness and confidence. Data completeness represents the percentage of filled records of the aforementioned key data fields. Data confidence refers to the accuracy and consistency of data. Note that the evaluation of data confidence applies to the City's data records only. It represents the City's evolution towards a data-driven analysis of state of infrastructure. In some cases, the City has detailed expert knowledge on the state of its infrastructure but has not recorded asset inventories or some data fields digitally. In these cases, the City might receive confidence scores of "Poor". These scores are not intended to be a reflection of the City's knowledge of its assets, only of the state of the City's data.

As part of this AMP development, the City's completed an asset inventory assessment and gap analysis of its applicable data. This analysis was documented in a technical memorandum (**Appendix A: Asset Inventory Assessment and Gap Analysis**). Refer to this memo for additional details on data maturity and confidence, as well as all assumptions made to address data gaps.

As part of this AMP development, the City has also developed a Data and Condition Assessment Plan (**Appendix B**). This plan provides recommendations to collect additional data in order to fill data gaps; and increase data maturity and confidence, which was developed in the technical memoranda.

2.5.2 Levels of Service

LOS are a measure of the degree to which an asset meets functional or user requirements. Typically, LOS are measured in terms of parameters that reflect social, political, environmental, and economic outcomes that an organization delivers. The LOS are organized into key service attributes that describe the service (for example reliable, quality and safe).

The LOS subsections within each chapter of this AMP document the established LOS indicators for each service. These LOS include a set of measures that are prescribed by O. Reg. 588/17, as well as LOS measures that were established by the City. The City has decided on a set of foundational LOS measures that are supported by data that the City currently collects. A set of advanced measures have been identified and will be tracked in the future; these measures are not currently tracked as the required supporting data is unavailable at the present time. This AMP reports on only the foundational measures. Future LOS measures are documented in the City's Levels of Service Strategy (**Appendix C**).

The City's LOS framework is presented in two tables within this AMP: the Community LOS Table and the Technical LOS Table. Each of these tables follow a slightly different structure but contain common elements that link them together. The structure of each table is as follows:

The **Community LOS** table consists of the following headings:

1. ***Subservice*** identifies the specific subservice that is provided to the community (ex. Sanitary Sewer Collection System, Combined Sewer Collection System, Storm Sewer Collection System, Water Distribution Network, Road Network, and Active Transportation).
2. ***Community Measures*** identify specific areas of focus that can be measured to support each *Subservice*. The community measures were developed to identify the way that the community experience each service. They contain the key features of each service that are important to the community. The Community Measures are linked to the Technical Measures that are provided in the Technical LOS table through the *Service Attributes* column. These also include the Community Measures that are prescribed by O.Reg. 588/17.
3. ***Service Attributes*** consist of a phrase or multiple phrases that describe an important characteristic for each *Subservice*. Examples of Service Attributes include Safe, Reliable, Operational and Environmentally Sustainable. The listed *Service Attributes* are meant to cover important aspects of the service and be easy for the community/public to understand and recognize. They are linked to the community measures, and attempt to describe each of the areas of focus that are

related to the Community's experience of the service (i.e., the Community Measure).

4. ***Current Performance*** are descriptions that indicate the current performance for each Community Measure for the most recent complete calendar year (which is 2021 at the time of the initial framework development).

The **Technical LOS** table consists of the following headings:

1. ***Subservice*** identifies the specific subservice that is provided to the community (ex. Sanitary Sewer Collection System, Storm Sewer Collection System, Combined Sewer Collection System, Water Distribution Network, Road Network, and Active Transportation).
2. ***Service Attributes*** are the same *Service Attributes* that are listed in the Community LOS table. These attributes link the Community to the Technical LOS. For every Service Attribute identified in the Community LOS table, there is one or more Performance Measures. As with the Community LOS table, the *Service Attributes* detail specific characteristics of each subservice that will be measured to support each *Subservice* and *Service Statement*.
3. ***Performance Measures*** identify specific areas of focus that can be measured to support each Service Attribute. One or more performance measures can be listed for each Service Attribute. Each Performance Measure has been developed to be SMART (specific, measurable, achievable, relevant, and time-bound).
4. ***Current Performance*** are values that indicate the current performance for each performance measure for the most recent complete calendar year (which is 2021 at the time of the initial framework development).

Each community and technical performance measure is categorized as one of the following:

- **Foundational Measures (shaded grey):** these measures represent core LOS measures that the City has developed and selected to be included as part of this AMP.
- **O. Reg. 588/17 Measures (shaded peach)**: These measures (for core assets only) are required to be included in this AMP by O. Reg. 588/17.

Note that the City's LOS Strategy tables contain additional information, including Service Statements, Data Source, and Proposed Performance columns. These columns have been omitted from this AMP in order to simplify LOS reporting within the document. They are detailed in the City's Levels of Service Strategy (**Appendix C**).

2.5.3 Lifecycle Management Strategy and Funding the Lifecycle Activities

The City's Lifecycle Strategy is the set of planned actions performed on assets to provide LOS in a sustainable way, while managing risk, at the lowest lifecycle cost. This section of the AMP is composed of the following:

- Descriptions of the specific lifecycle activities applied to each asset.
- The forecasted lifecycle activity costs illustrating the capital and operational needs across the entire asset lifecycle from creation to disposal. Note that these costs are provided in a separate section for each subservice, entitled "Funding the Lifecycle Activities".

Lifecycle activities are important as they work together to extend the asset life, reduce overall lifecycle costs, and achieve other objectives such as environmental goals and balancing risk. The asset lifecycle activities are detailed according to the categories provided in Table 2-2.

Table 2-2: Lifecycle Activity Categories and Descriptions

Lifecycle Activity Category	Description
Non-Infrastructure	▪ Actions or policies that can lower costs or extend asset life.
Operations and Maintenance	▪ Regularly scheduled inspection and maintenance, or repair and activities associated with unexpected events.
Renewal/ Rehabilitation	▪ Significant repairs designed to extend the life of the asset.
Replacement	▪ Activities that are expected to occur once an asset has reached the end of its useful life and renewal/ rehabilitation is no longer an option.
Service Improvement	▪ Planned activities to improve an asset's capacity, quality, and system reliability.
Disposal	▪ Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed by the municipality. ▪ Costs are typically combined with rehabilitation or replacement activities.
Expansion	▪ Planned activities required to extend services to previously un-serviced areas - or expand services to meet growth demands.

The City's Lifecycle Management Strategy (**Appendix D**) details the lifecycle activities and associated mathematical models used to forecast asset lifecycle needs.

The lifecycle models developed within the City's lifecycle strategy have been combined with the City's LOS and Risk Management Strategy (**Appendix E**) in a decision support system (DSS) model, which allowed the City to run various forecasting scenarios. Five (5) forecasting scenarios were analyzed for the City's assets, which provided insight on the City's current renewal status, and the LOS that the City would achieve under various budgetary or condition-based targets. The following are the five (5) scenarios that were analyzed:

- **Scenario 1: Anticipated Budget** – Evaluates asset performance under the current 10-year capital plan that the City anticipates to allocate towards that asset class. The current budgets were obtained from the City's financial plan. This is used to illustrate the change in LOS under anticipated conditions. It is also used as a baseline scenario, which can be used to assess the other scenarios analyzed (detailed below).
- **Scenario 2: Cost to Maintain LOS** – This scenario determines the cost that would be required to maintain LOS at current levels over a 10-year forecast period. Understanding the cost to maintain LOS at current levels is a requirement of the July 1, 2022 milestone of O.Reg. 588/17. It details the costs that would be required to maintain the existing state of infrastructure over the next 10-years.
- **Scenario 3: Achieve Target LOS in 10-years** – The City has established LOS targets that it intends to achieve. The City's targets are to ensure that 100% of assets meet the City's LOS. This scenario determines the costs and associated asset performance to achieve these targets over a 10-year forecast period. These targets generally apply to the reliability/condition based LOS that the City has established, which either include maintaining assets in a condition of fair or better, or ensuring assets do not exceed their service lives.
- **Scenario 4: Achieve Target LOS in 25-years** – This scenario determines the cost and associated asset performance to achieve the City's target LOS over a 25-year forecast period. Note that this is the same target as described in the scenario above, but over a 25-year forecast period instead of a 10-year forecast period.
- **Scenario 5: Backlog Analysis** – This scenario evaluates the cost to address all asset needs, including existing backlog, under the assumption that the City has unlimited funding available. The purpose of this analysis is to assist the City in understanding backlogs and future asset needs based on lifecycles.

The results of these scenarios helped inform the City's Financial Strategy. These scenarios provided analysis and insight on the City's spending needs with respect to asset renewals (i.e. rehabilitations, replacements and disposal). The Financial Strategy goes further, and includes costs associated with other lifecycle activities including non-infrastructure, operations and maintenance, service improvements and expansion.

In addition to the abovementioned scenarios, the city has completed an analysis of various other scenarios that are not included within this AMP. Other scenarios include a 50-year analysis of renewal needs, as well as the "zero funding" scenario. The "zero funding" scenario provides insight on what the condition of assets would be if no investment was undertaken to continue asset renewals and address backlogs. This scenario illustrates the positive effects of investments, and the consequences of not investing in asset renewals. It is a useful tool in understanding the effects of investments on infrastructure assets.

2.5.4 Financial Strategy

The financial strategy is one of the key components within the AMP, as it puts the AMP into action. The financial plan provides a way for municipalities to integrate asset management planning with financial budgeting.

The Financial Strategy forecasts the required annual expenditures for the City to perform the lifecycle activities in alignment with the lifecycle management strategies to maintain desired LOS:

- Expansion Activities
- Non-infrastructure Solutions
- Renewal Activities
- Disposal Activities
- Service Change Activities
- Operations and Maintenance Activities

Each category includes the City’s forecasted expenditures from its capital budget, to understand the full cost of maintaining service levels over the 10-year forecast period. Forecasts for lifecycle activities will be compared to the capital budget forecasts to determine if an infrastructure gap is present. Strategies to address this gap will also be discussed.

Note that forecasts for major capital works including renewal/rehabilitation and replacement activities are derived from an asset management analysis of the City’s data. The logic used to complete this asset management analysis was developed through the City’s Levels of Service Strategy (**Appendix C**), Lifecycle Management Strategy (**Appendix D**) and Risk Management Strategy (**Appendix E**). For other costs, such as maintenance, and non-infrastructure and service improvements, the assumption was made that the capital forecast will adequately address needs over the forecast period.

Asset report cards were also developed in parallel with the City’s AMP. The report cards provide one-page summaries for each asset class, which summarize key details of this AMP, including state of the infrastructure information and results of the financial strategy. The state of infrastructure report cards are provided in **Appendix F**.

2.5.5 Improvement Plan

Ontario Regulation 588/17 encourages municipalities to put an emphasis on a continuous improvement approach to asset management. Ensuring an open document requires monitoring and reporting on the implementation of asset plans to Council and staff.

The improvement plan provides commentary on each major section of the AMP, and details processes and actions that the City can undertake to continually improve the data, systems and processes that support this AMP, for future iterations.

The improvement plan is organized according to the following sections:

- General Asset Management
- State of the Infrastructure
- Levels of Service
- Lifecycle Management Strategy
- Financial Strategy

3. ALIGNMENT TO CITY GOALS

The City has developed an AM Framework that illustrates the key AM processes and their integration in the City's AM Program. The City's AM process is illustrated in Figure 3-1.

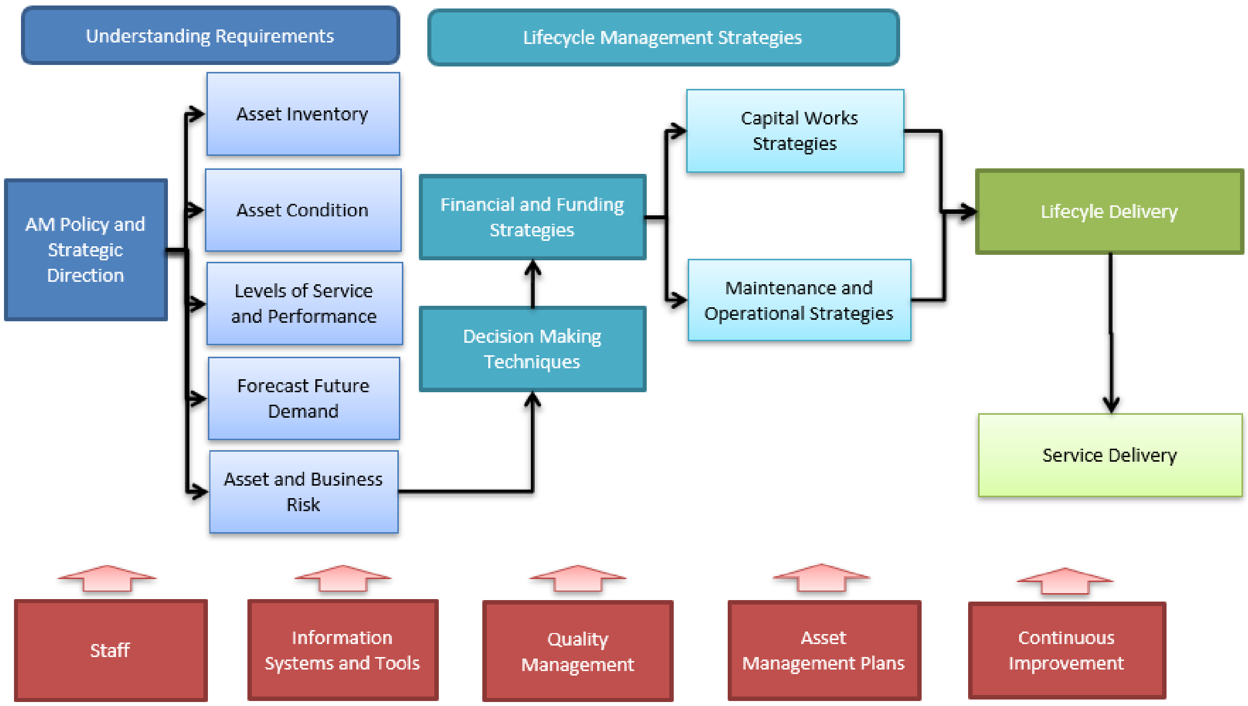

Figure 3-1: Asset Management Process

A key part of asset management within an organization is the concept of an Asset Management System. An AM System is a management system that describes how asset management will be enacted and achieved in the organization. The City's AM system is illustrated in Figure 3-2.

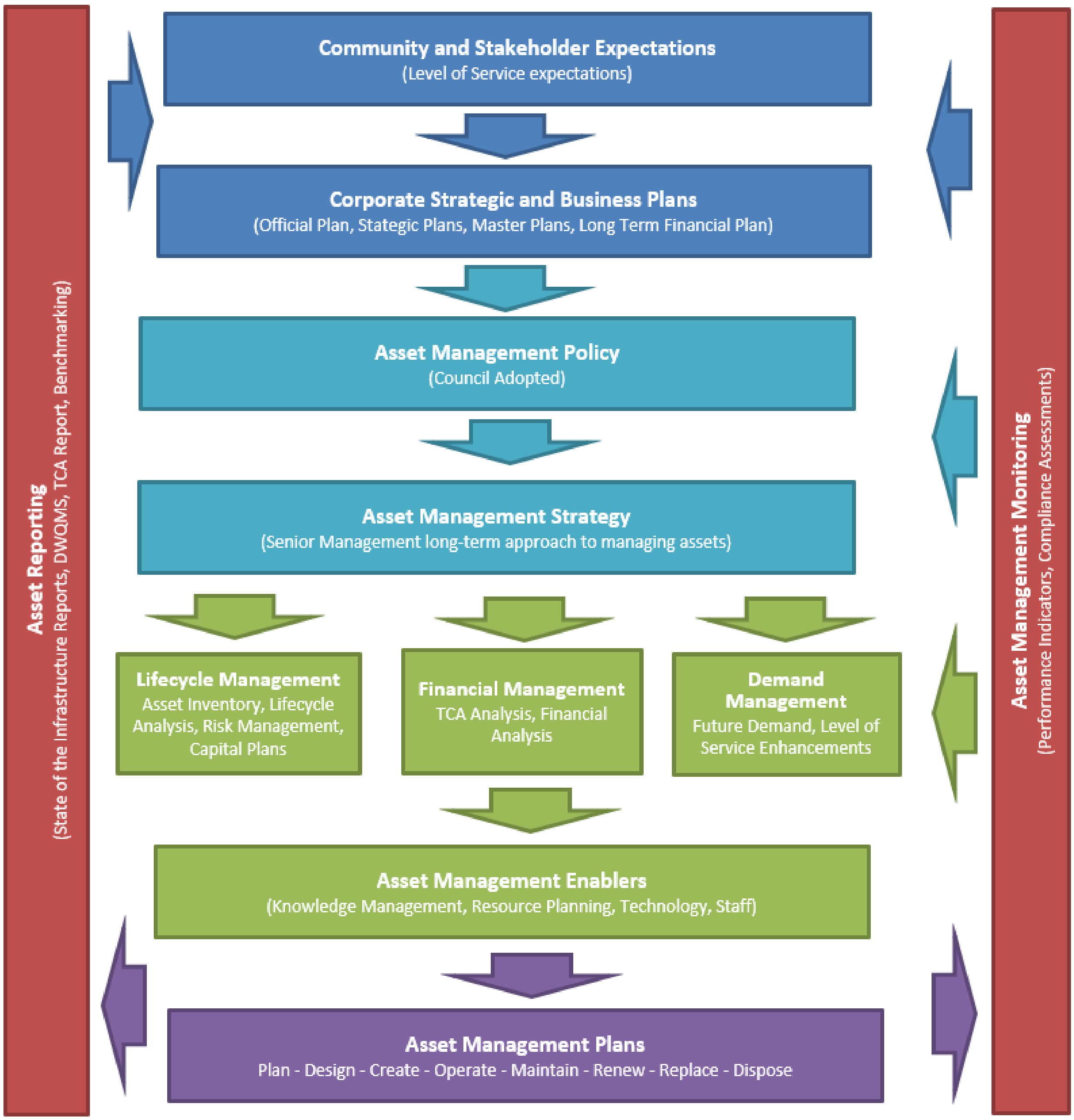

Figure 3-2: Asset Management System

Subsections 3.1 to 3.4 discuss how this AMP aligns with the City's goals, within the context of its AM framework.

3.1. ALIGNMENT WITH CITY STRATEGIC PLAN

The City's strategic plan sets out its strategic priorities for 2019 – 2022. These strategic priorities are:

1. Developing waterfront through ownership, partnerships for business, recreational opportunities.
2. Attracting, enhancing workforce that meets demands of local employers.
3. Growing quality of housing stock, including affordable housing.
4. Economic development and pursuing diverse population growth of 50,000
5. Being leaders in sustainability and climate change impact.

This AMP has alignment with several of these priorities. By having a service-centric approach, this AMP helps to build a better City overall, by ensuring that assets are managed to support services to support the community; and encourage population and business growth in a sustainable manner.

Furthermore, this AMP details the financial strategies that the City will enact to provide service levels, including those related to both growth and renewal of assets, in line with priorities 1 and 4. It also details the strategy of investment in infrastructure renewal in line with priority 4. It illustrates the City's commitment to sustainability, in line with priority 5, by accounting for the full lifecycle of assets.

3.2. ALIGNMENT WITH ASSET MANGEMENT POLICY

In 2019, the City finalized their AM Policy with the policy statement to "support the City of Cornwall's commitment of focusing its infrastructure efforts on managing risk, addressing priorities and costs in regard to short and long-term infrastructure needs."

Along with the City's AM Policy, this AMP is a major component in the City's overall AM System. This AMP is aligned with the AM Policy's vision by:

- Providing a service-centric approach to asset management planning.
- Developing standardized and consistent frameworks for understanding LOS, risk and lifecycle strategies.
- Providing the City with the information it needs to make infrastructure investment decisions to balance lifecycles, provide service, prioritize needs and minimize risks at the lowest possible costs.
- Supporting sustainability by taking a risk-centric and full lifecycle approach to financial strategies, lifecycle forecasts and infrastructure investment decisions.
- Providing the information to support prudent financial planning and decision-making.
- Complying with regulatory requirements, including the requirements of O.Reg. 588/17.

3.3. COVID-19 PANDEMIC IMPACTS

This AMP was developed during the COVID-19 pandemic. At present, the full economic impacts of the COVID-19 pandemic are somewhat uncertain, and their effects on the City's Asset Management Planning are not yet known.

The City acknowledges that these economic impacts related to the COVID-19 pandemic are not reflected within this AMP and that these impacts will be addressed at a later date if necessary.

Risks include, but are not limited to, delays and changes in construction schedules due to health restrictions, supply chain difficulties, and high inflation. These and other risks are discussed further in Section 7.2.

The City has prepared this AMP using the best available information at the time of writing, including estimated costs and anticipated risks.

3.4. ONTARIO REGULATION 588/17

On January 1, 2018, Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure came into effect. The regulation sets out requirements for municipal asset management planning to help municipalities better understand their infrastructure needs and inform infrastructure planning and investment decisions.

The regulation will be phased in over six years and in 2025 will culminate in the development of an AMP that addresses the future investment needs for all infrastructure assets owned by the City.

Key legislative deadlines for all Ontario municipalities are provided in Table 3-1.

Table 3-1: O.Reg. 588/17 Milestones and Timelines

Date	Milestone	City of Cornwall Status
July 1, 2019	Prepare and publish a strategic asset management policy.	Complete – June 2019
July 1, 2022	Develop enhanced AMPs that include the cost to maintain current service levels covering core infrastructure assets.	Presented in this AMP
July 1, 2024	Expand enhanced AMPs that include the cost to maintain current service levels covering all infrastructure assets.	2023/2024 Project
July 1, 2025	Expand AMPs to provide further details on all infrastructure assets, including proposed service levels and the revenue and expenditure plan to achieve the proposed service levels (if greater than current service levels).	2024/2025 Project

This AMP has been developed in line with the requirements of O.Reg. 588/17 and meets the requirements for the July 1, 2022 milestone. This AMP addresses these requirements as follows:

- It applies to assets that are defined as “core assets” in O.Reg. 588/17 (note that the City also has developed a separate AMP for some of its other core assets, not included within the scope of this document).
- It details the current performance for Community and Technical LOS specified in O.Reg. 588/17.
- It includes a summary, replacement costs, average age, and condition (refer to the “State of Infrastructure” sections).
- It includes a description of the City’s approach to assessing the condition of assets (refer to the “State of Infrastructure” sections).
- It includes a description of the lifecycle activities that need to be undertaken in order to maintain current LOS, as well as risks associated with those activities (refer to the “Lifecycle Management” sections).
- It includes population and employment forecasts as set out in the City’s official plan.
- It includes the estimated capital expenditures and operating costs related to the lifecycle activities required to maintain current LOS and accommodate growth.
- It applies a 10 and 25-year horizon to these activities and projections.
- It is supported by the best available and most current data that is available at the City.

Furthermore, for the last several years, the City has been working towards achieving target LOS for several of its asset classes through its asset management program and past AMP. This 2022 AMP provides the City with a new suite of LOS measures, in alignment with O.Reg. 588/17. For some of those measures, the City is already working towards achieving proposed (or target) LOS, which puts them partially in alignment with the requirements of the July 1, 2025 milestone of the regulation. These areas, where the City is working towards achieving a proposed LOS, will be detailed further in the “Funding the Lifecycle Activities” sections for each subservice, as well as the Financial Strategy section of this AMP.

4. UTILITIES

4.1. SUMMARY

The City's Utilities service includes the subservices of Sanitary Sewer Collection System, Combined Sewer Collection System, Storm Sewer Collection System and Water Distribution Network. These services are responsible for providing water, collecting wastewater, and managing stormwater in the community.

An overall summary of the replacement value and condition of the assets within this service area is provided in Figure 4-1. Subsections 4.2 to 4.5 provide additional details on the asset classes within each subservice.

Although the majority of the Utility related assets are in Good condition, expenditures are required for lifecycle strategies to address Poor and Very Poor assets, prevent other assets from reaching Poor condition and maintaining service levels.

	Replacement Value	Condition
Sanitary Sewer Collection System	$233.41M	Very Good
Combined Sewer Collection System	$196.98M	Good
Storm Sewer Collection System	$207.50M	Good
Water Distribution Network	$345.87M	Fair
Utilities Total	$983.76M	

Figure 4-1: Utilities Condition and Replacement Value Summary

4.2. SANITARY SEWER COLLECTION SYSTEM

The City of Cornwall is responsible for collecting wastewater from residents and businesses through the sanitary sewer collection system and treating the flows at the wastewater treatment plant. The City strives to provide sanitary services with minimal service disruptions that are also environmentally conscious and have minimal effects on the St. Lawrence River. To achieve this, the City is responsible for maintaining and replacing sanitary assets that are provided in Figure 4-2.

Figure 4-2: Asset Classes of the Sanitary Sewer Collection System

This section documents the current state of assets within the sanitary sewer collection system, the LOS provided to citizens, the lifecycle activities performed on the assets, and the funding required to provide service levels and minimize risk. Note that this AMP only covers the asset classes detailed above. The City's Wastewater Treatment Plant is not included within the scope of this AMP and is covered in a separate AMP. Furthermore, note that assets such as manholes and sewer laterals are included within the Sanitary Sewer asset class.

4.2.1 State of Infrastructure

Asset Inventory and Valuation

The replacement cost for the sanitary sewer collection system is approximately $233.4 million and is summarized in Figure 4-3 and Table 4-1.

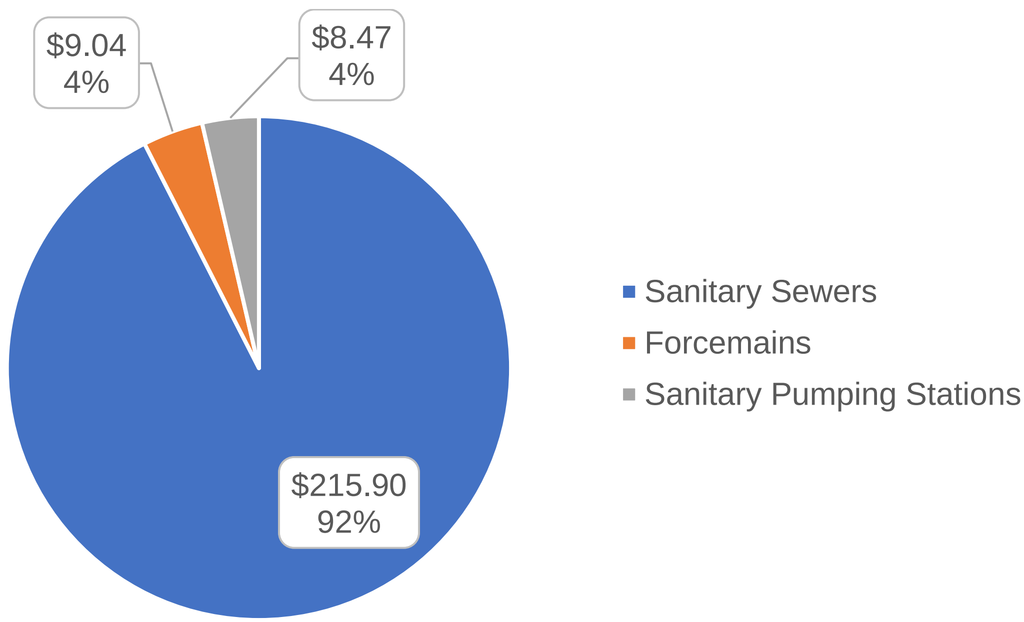

Figure 4-3: Sanitary Sewer Collection System Valuation ($M)

Table 4-1: Sanitary Sewer Collection System Asset Quantities

Category	Asset Category	Asset Class	Quantity	Replacement Cost
Sanitary Sewer Collection System	Linear	Sanitary Sewers	199.50 km	$215.90M
		Forcemains	4.92 km	$9.04M
	Vertical	Sanitary Pumping Stations	6 Facilities	$8.47M

Age Summary

The average age of assets compared to the average estimated service lives for the sanitary sewer collection system is provided in Figure 4-4. Presenting the asset portfolio in this manner provides a high-level understanding of the average age of sanitary assets relative to their lifecycles, which in turn can give an idea of overall condition based on age. For the Sanitary Sewer and Forcemain asset classes, a comparison of average age to the average estimated service lives is also provided at a more granular level (by material type) in Figure 4-5 and Figure 4-6. The average age and ESL values were weighted by replacement cost.

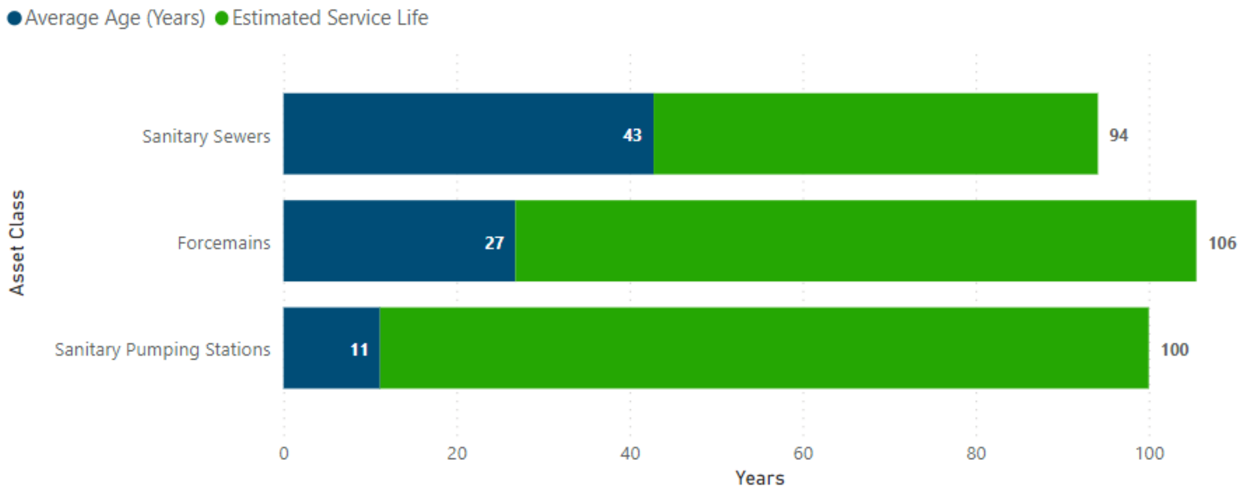

Figure 4-4: Sanitary Sewer Collection System Average Age as a Proportion of Average ESL (Weighted by Replacement Cost)

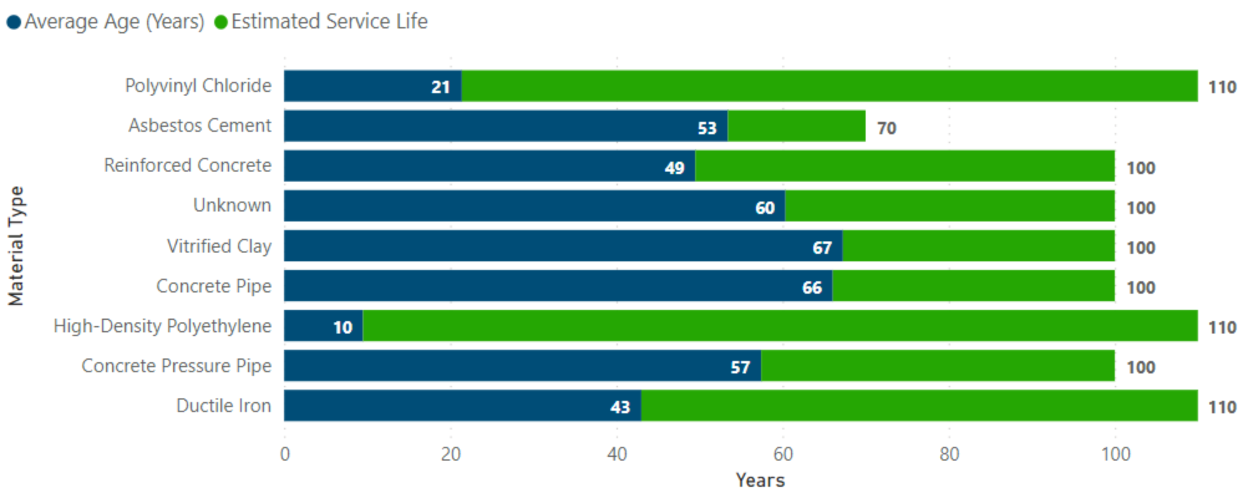

Figure 4-5: Sanitary Sewers Average Age as a Proportion of Average ESL by Material (Weighted by Replacement Cost)

Note that the ESL for the “Unknown” material type was given as 100 years. This was done since data that had unknown material types tended to be for pipes with older installation dates. The City’s inventory of newer pipes have more complete data associated with them. Therefore, it is likely that records with unknown material types represent older pipes. The ESL of 100 years aligns with ESLs of material types typically found on older pipes, such as Vitrified Clay or concrete pipe.

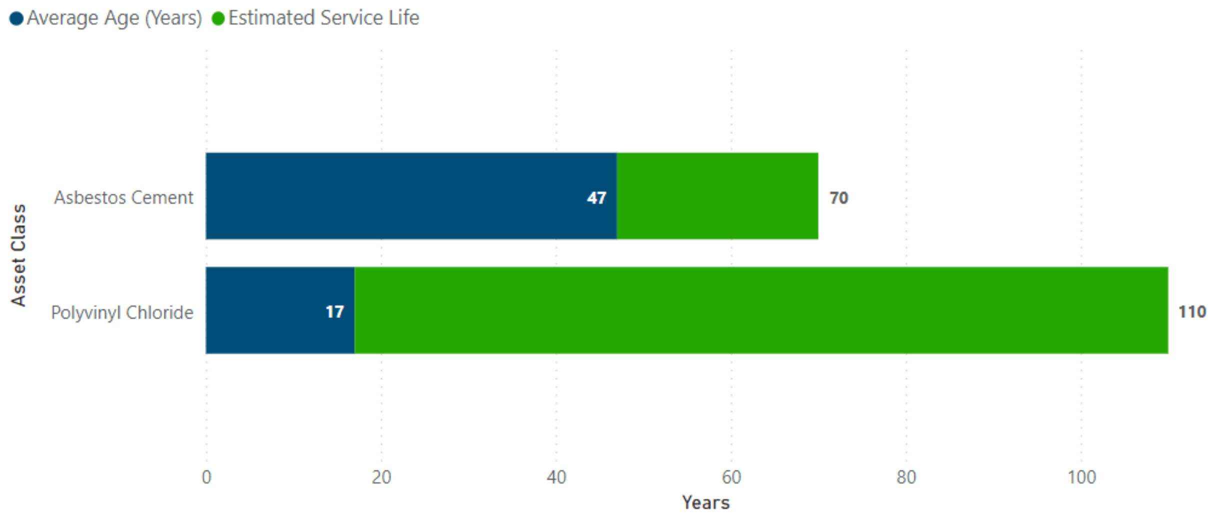

Figure 4-6: Forcemains Average Age as a Proportion of Average ESL by Material (Weighted by Replacement Cost)

The pipes within the sanitary sewer network consist of various material types, each with a unique service life value attributed to it. The material type, service life and remaining lifespan of each sanitary sewer material type is summarized in the Table 4-2.

Table 4-2: Sanitary Sewer Service Life

Material	Length (km)	Percentage of Network (%)	Service Life (Years)	Average Age (Years)	Remaining Service Life (Years)
Polyvinyl Chloride	72.00	36.09%	110	22	88
Asbestos Cement	68.41	34.29%	70	54	16
Reinforced Concrete	25.69	12.88%	100	48	52
Unknown	12.73	6.38%	100	54	21
Vitrified Clay	12.99	6.51%	100	68	32
Concrete Pipe	6.80	3.41%	100	66	34
High-Density Polyethylene	0.43	0.22%	110	9	101
Concrete Pressure Pipe	0.41	0.21%	100	57	43
Ductile Iron	0.04	0.02%	110	43	67

The distribution of assets by construction date is provided in Figure 4-7. It illustrates that the largest historical investment in the sanitary sewer system was made between 1970 and 1974. The 1970's increase in construction activity in Sanitary sewers occurred due to the joint Ontario Water Resources Commission (OWRC) projects that began in the late 1960's and continued into the 1970's. The sewer system project was the most extensive undertaken by the Commission for an individual municipality. This resulted in an increase of the construction of trunk sewers, as well as a general overall increase in sewers. The increase in construction activity for this time period can also be seen in other asset classes, such as Watermains. Furthermore, the City's efforts to reduce the amount of combined sewers resulted in a change to dedicated sanitary sewers, which is evident by the increased construction in the 1970's. Due to the increases in the 1970s, the City can expect to see an increased need in replacement in the future (beyond the scope of analysis for this AMP), as these pipes near the end of their service lives and require replacement.

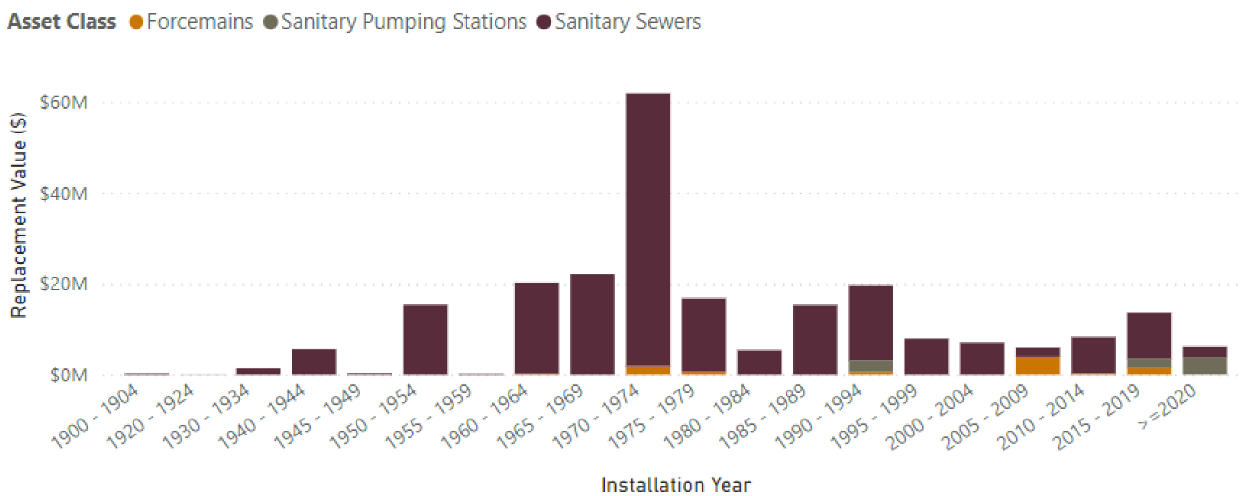

Figure 4-7: Sanitary Sewer Collection System Construction Date Distribution

Asset Condition

The City has been assessing the condition of sanitary sewers and forcemains via CCTV inspections, using the NAASCO pipeline assessment certification program (PACP) standardized condition rating scores. These condition scores are developed by completing CCTV inspections of pipes and assigning scores to pipes based on the structural defects and blockages observed during the inspections. PACP scores range from 0 - 5 and is then converted to a 1-5 score in the data base (with 1 indicating good condition and 5 indicating poor condition).

Life consumed was used to determine asset condition for vertical assets. Table 4-3 presents the logic used to convert PACP grades and life consumed values into a condition category. The condition distribution by replacement value is provided in Figure 4-8 and Figure 4-9.

Table 4-3: Sanitary Sewer Collection Condition Ratings

Category	Life Consumed	Condition Ratings	
		Sanitary Sewers, Forcemains (PACP & Blockage Grades)	Sanitary Pumping Stations
Very Good	0% to 25%	1	Life Consumed is the metric used to evaluate condition for this asset class
Good	25% to 50%	2	
Fair	50% to 75%	3	
Poor	75% to 100%	4	
Very Poor	>100%	5	

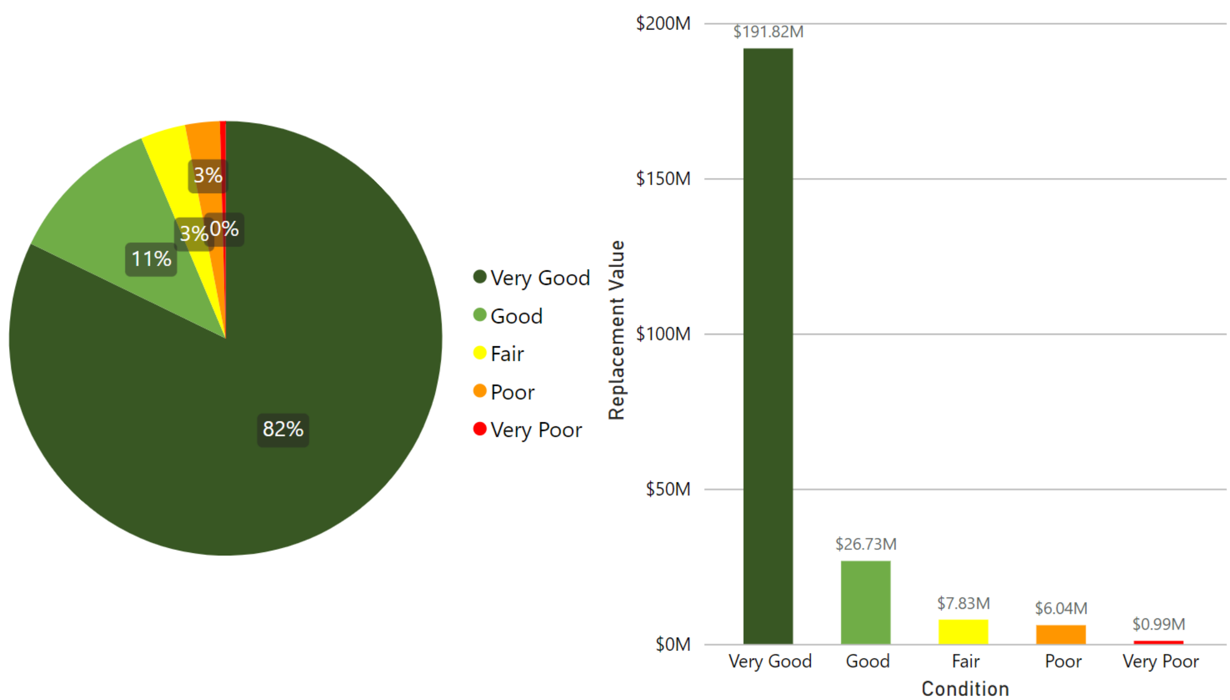

Figure 4-8: Sanitary Sewer Collection System Overall Condition

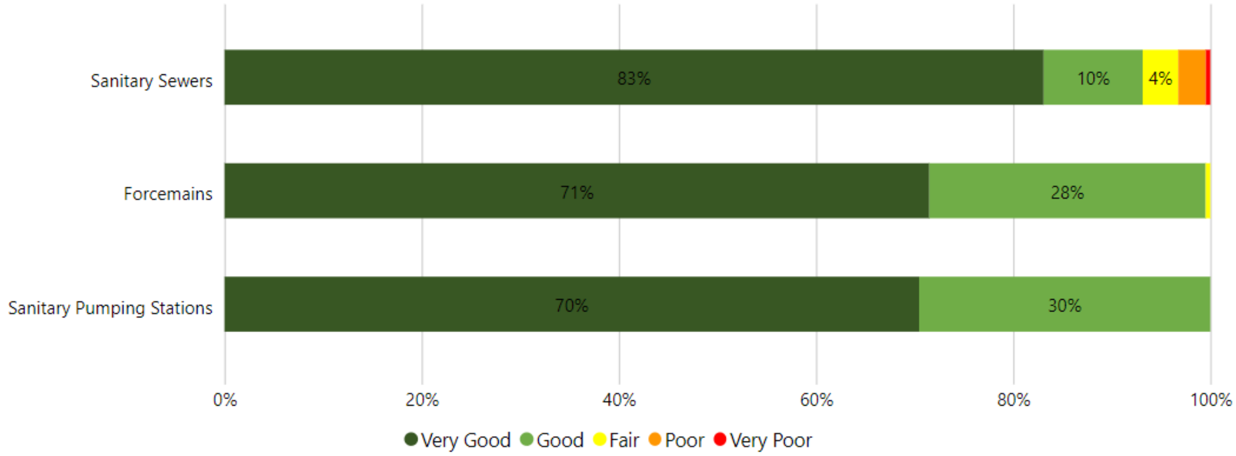

Figure 4-9: Sanitary Sewer Collection System Condition Distribution by Replacement Value

Data Sources and Confidence

The data sources to support this state of the infrastructure analysis as well as the other AM planning analyses required to complete this AMP are provided in Table 4-4.

Table 4-4: Sanitary Sewer Collection System - Condition Data Collection

Asset Class	Condition Data Collection Technique	Frequency
Sanitary Sewers	▪ CCTV inspection completed to collect condition data as per the PACP standard.	▪ Annually, scope of inspections based on needs
Forcemains	▪ CCTV inspection completed to collect condition data as per the PACP standard.	▪ Annually, scope of inspections based on needs
Sanitary Pumping Stations	▪ Building condition assessments completed of pumping stations and associated assets	▪ 10 years (approx.) ▪ 2013 most recently completed

The data completeness and confidence values for the aforementioned data is summarized in Table 4-5.

Table 4-5: Sanitary Sewer Collection System - Data Confidence

Asset Class	Completeness	Confidence	Comments
Sanitary Sewers	**Good**	**High**	Approx. 8% of assets missing condition data. 6% of assets have unknown pipe material.
Forcemains	**Good**	**High**	Approx. half of assets missing condition data and inspection year.
Sanitary Pumping Stations	**Good**	**Low**	Data is available at the facility level only, and not at the asset-level. Therefore, data completeness is high for the facilities, but confidence is considered to be low, since information on each asset within the facilities was not collected and recorded digitally.

4.2.2 Levels of Service

The City's goal is to provide reliable, operational, and environmentally sustainable sanitary collection services to all its residents and businesses. This means ensuring minimal service disruptions, ensuring all assets remain in a state of good repair by performing regular maintenance, and minimizing environmental impacts on the St. Lawrence River, all while optimizing lifecycle costs. The community and technical LOS for the sanitary sewer collection system are provided in Table 4-6 and Table 4-7 below. The measures are categorized in two types: Mandatory LOS measures as per O. Reg. 588/17, and foundational measures selected by the City.

(orange)	Represents a mandatory LOS measure as per O. Reg. 588/17
(grey)	Represents a foundational measure selected by the City

Note that the City has defined a subservice for its Combined Sewer Collection System, which is separate from the Sanitary Sewer Collection System. Note that some mandatory O.Reg. 588/17 Levels of Service detailed below refer to combined sewers. They are provided within this section as well as in the Combined Sewer Collection System Levels of Service Subsection (Subsection 4.3.2).

Table 4-6: Sanitary Sewer Collection System Community Levels of Service

Subservice	Community Measures	Service Attributes	Current Performance
Sanitary Sewer Collection System	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system.	Scope	Approximately 98% of properties within urban areas are connected to the municipal wastewater system.
	Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes.	Reliable	No combined sewers allowed in new construction design. The City has constructed overflow structures that collect excess flow to ensure that backups into homes are minimized or prevented.
	Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches.	Reliable	The City has not experienced any overflows in habitable areas or beaches last year.
	Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes.	Reliable	Some Inflow and Infiltration into sanitary system exists. Infiltration occurs when stormwater enters the system through damages and deficiencies in the infrastructure, such as cracks. Infiltration occurs when stormwater enters the system through direct connections, such as roof drains, floor drains, foundation drains and other connections.

Subservice	Community Measures	Service Attributes	Current Performance
	Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described in the above metric.	Reliable	Design and construction criteria for sanitary sewers in place, to ensure consistent and industry-accepted performance requirements, materials, and installation methods are used.
	Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system.	Reliable	The City's sewage treatment plant is covered in a separate AMP document.
	Sewer backups minimized	Reliable, Operational, Environmentally Sustainable	The Sanitary Sewer System technical LOS measures indicate that the network has a high degree of reliability, minimal unplanned events, and minimal environmental impacts, indicating that sewer backups are minimized.
	Wastewater does not harm the environment	Environmentally Sustainable	The technical metrics for environmental sustainability report no overflows as a result of mechanical failures, which indicates that the City is achieving its community objectives.
	Adverse odours are minimized	Quality	Odour complaints are addressed on a case-by-case basis, the other service attributes also indirectly address odour issues by providing reliability, etc.

Table 4-7: Sanitary Sewer Collection System Technical Levels of Service

Service Attribute	Performance Measure	Current Performance
Scope	Percentage of properties connected to the municipal wastewater system. (properties/properties billed by sewer service)	91%
Reliable	The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system.	11 events for 15,471 properties
	The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system.	0
	The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.	0
	Percentage of sanitary sewers that are in fair or better condition	97%
	Percentage of forcemains that are in fair or better condition	100%
	Percentage of sanitary pumping station condition assessment recommendations that have been completed	100%
Operational	Annual number of unplanned flushing events for sanitary sewers	2
Environmentally Sustainable	Number of sanitary system overflows as a result of mechanical failures per year	0

4.2.3 Lifecycle Management Strategy

Lifecycle Activities

For the City to provide sanitary collection services and maintain LOS, various lifecycle activities are performed on the sanitary sewer collection assets. These include non-infrastructure solutions such as developing plans and performing condition assessments; maintenance activities to repair and clean assets; relining sewers to rehabilitate them; replacing assets; asset and material disposal; and expanding and upgrading assets to support growth. Table 4-8 and Table 4-9 summarize the lifecycle activities performed on sanitary sewers, forcemains, and pumping stations.

Table 4-8: Sanitary Sewers and Forcemains Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, capacity studies, AMPs)	As required
	Wastewater model	As required, based on needs
	CCTV Inspections	Annual, scope of inspections is based on needs
	Water usage reduction incentives	Ongoing
Operations and Maintenance	Spot Repairs	As required Repairs also completed in conjunction with asphalt resurfacing works
	Lateral and maintenance hole repairs	As required Repairs are also completed in conjunction with asphalt resurfacing works
	Flushing	Prior to CCTV, based on identified issues, and during construction and commissioning
Rehabilitation	Relining	When asset reaches poor condition, where feasible Note, relining is considered an option in situations where it would be challenging to replace the pipe via open cut
Replacement	Full pipe replacement	When asset reaches poor condition
	Maintenance hole and lateral replacement	Coordinated with sewer replacement
Disposal	Removed as part of the project or abandoned	Coordinated with sewer replacement
Expansion/Service Changes	Pipe upsizing	Based on growth, modelling and studies
	New subdivisions	Through development
	Coordination with other related works	Based on corridor analysis

Table 4-9: Sanitary Pumping Stations Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, capacity studies, AMPs)	As required
	Wastewater model	As required, based on needs
	Condition assessments	Approx. every 10 years (varies)
	Water usage reduction incentives	Ongoing
Operations and Maintenance	Staff inspections	Weekly
	Reactive and preventive maintenance	Following PM programs, or as needed
Rehabilitation	Rehabilitation needs	Based on inspections and condition assessments
Replacement	Equipment or building component replacement	When assets reach end of service life
Disposal	Building and equipment disposal	Coordinated with asset replacement
	Equipment re-use	As required where possible
Expansion/Service Changes	Pump/Equipment Upsizing	As identified in the Master Plan and Capacity Studies/Analysis
	Expansion	Through development
	SCADA system and software upgrades	As needed

4.2.4 Funding the Lifecycle Activities

The City uses the lifecycle strategies described in Section 4.2.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Sanitary assets (sanitary sewers, forcemains and pumping stations) was defined as the percentage of assets that are in fair or better condition.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments of $946k annually, resulted in the performance forecast illustrated in Figure 4-10. Under this scenario, the percentage of assets that are in fair or better condition will nearly reach 100% at the end of the 10-year forecast period.

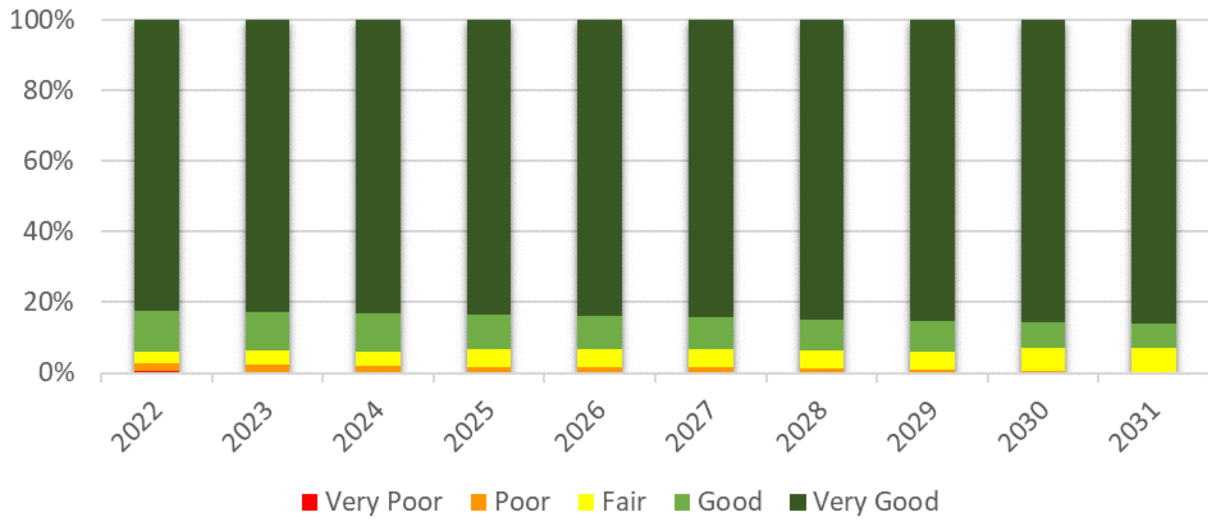

Figure 4-10: Sanitary Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $300K annually over a 10-year period and resulted in the performance forecast illustrated in Figure 4-11. Under this scenario, the percentage of assets that are in fair or better condition is approximately 97% in this scenario by the end of the forecast period.

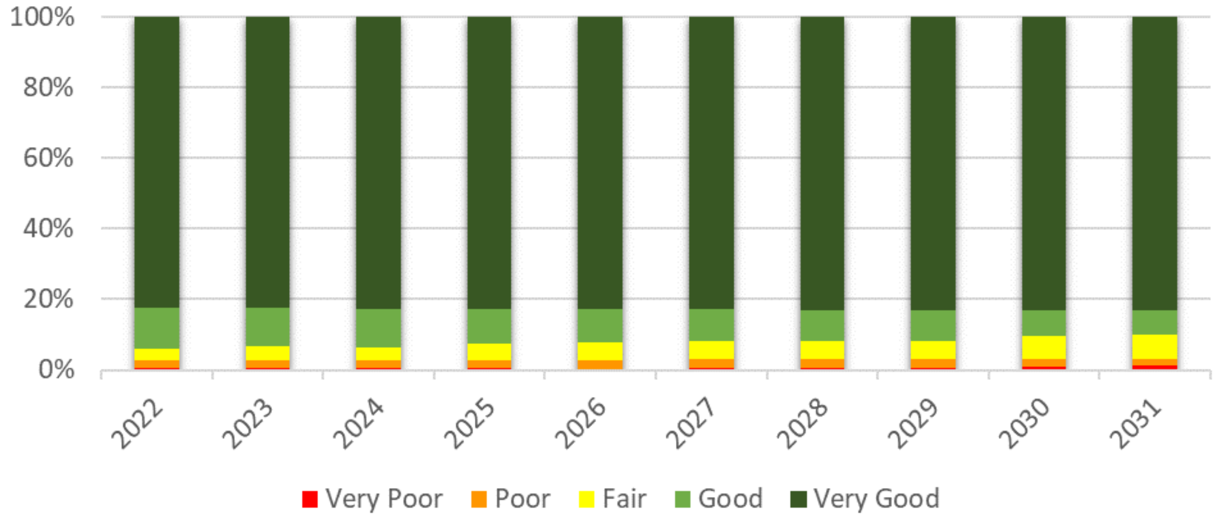

Figure 4-11: Sanitary Performance Forecast with Cost to Maintain LOS

Scenario 3: Achieve LOS in 10 Years

The City has set its proposed (target) LOS to ensure that 100% of assets in fair or better condition. The cost to meet this proposed LOS in 10 years was determined to be $1.0M annually and resulted in the performance forecast illustrated in Figure 4-12.

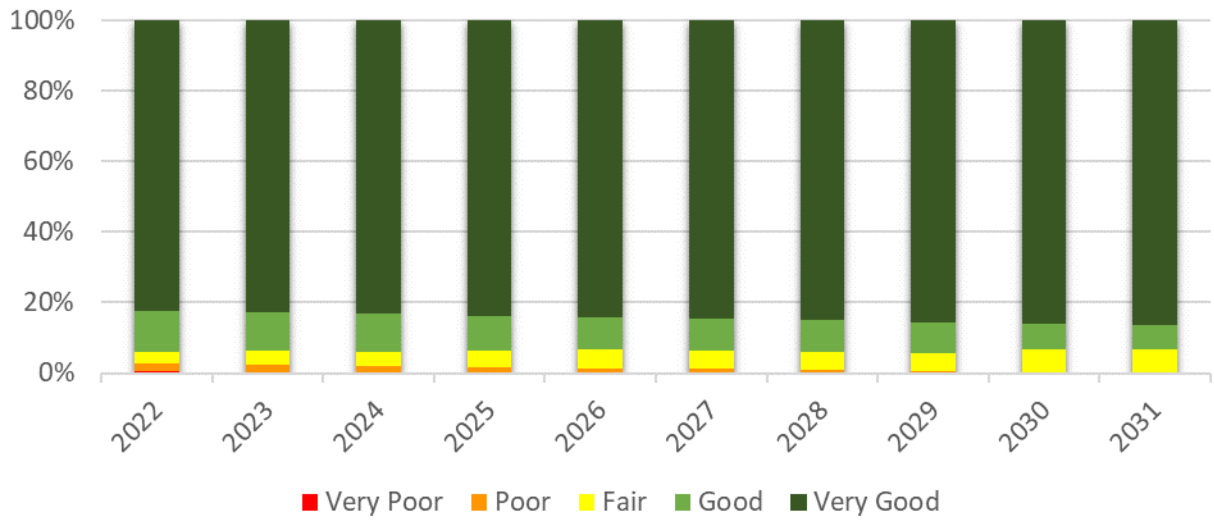

Figure 4-12: Sanitary Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to achieve the City's proposed LOS over a 25-year period was determined to be $869K annually and resulted in the performance forecast illustrated in Figure 4-13.

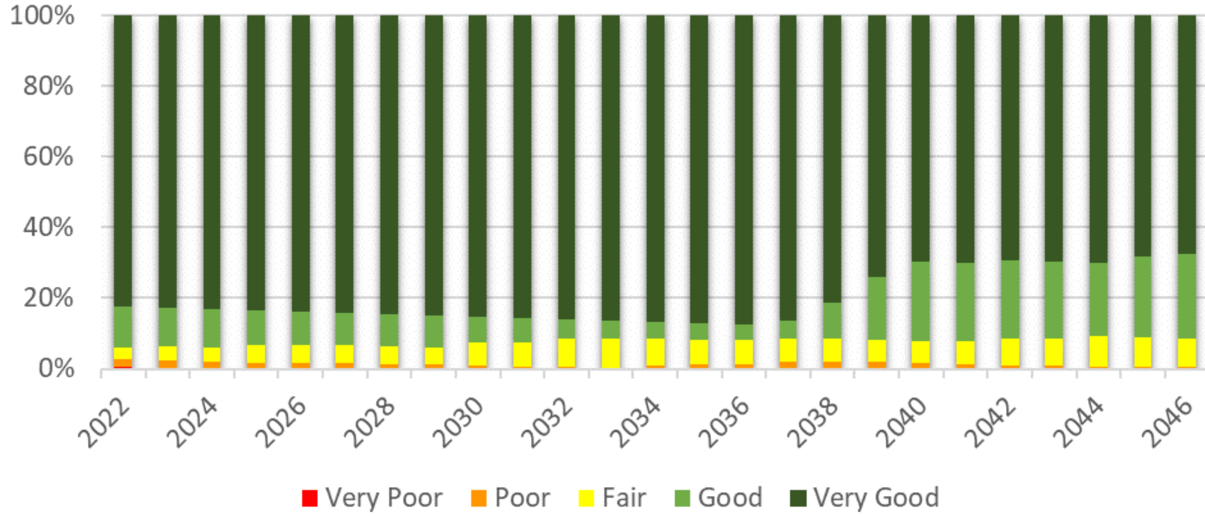

Figure 4-13: Sanitary Performance Forecast with Cost to Achieve LOS in 25 Years

Scenario 5: Backlog Analysis

The backlog analysis indicated that a $7.3M (7.0km) backlog is present for Sanitary Sewer Collection assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 4-14.

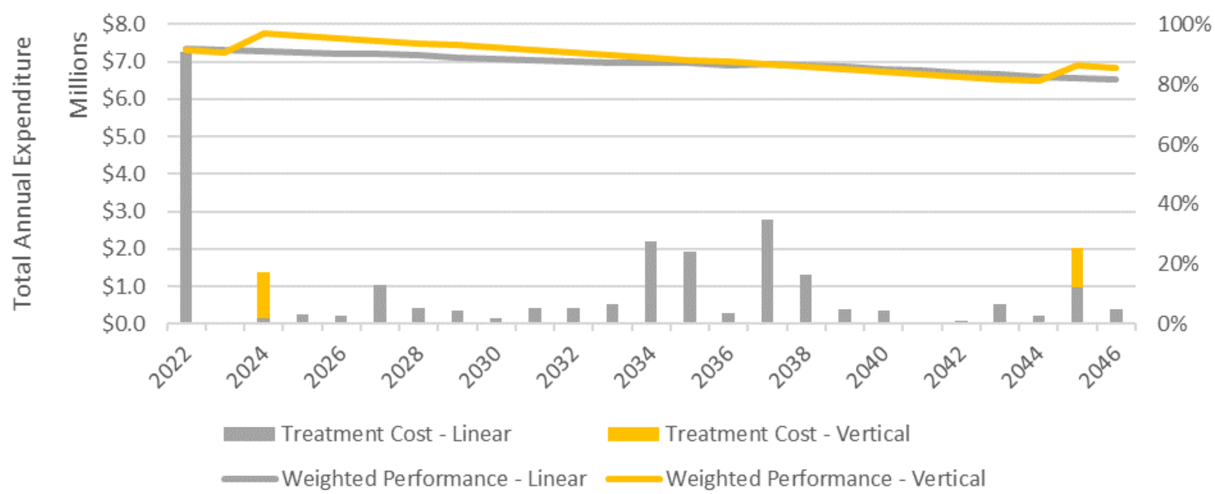

Figure 4-14: Sanitary Backlog Analysis

4.2.5 Recommendations

The results of the various scenario analyses indicated that the City's current planned budget over the next 10 years is slightly lower than the budget needed to meet its proposed LOS target of 100% of assets in fair or better condition over the next 10 years. By minimizing the amount of pipes in poor or very poor condition, the City hopes to avoid scenarios where aged pipes exist below new roads, which would result in possible unnecessary road works to address the sanitary issue below.

Note that the nature of the City's sanitary sewer replacement program is that it is combined with other related corridor assets, such as associated road, storm sewer and water assets. Executing work as part of a bundled corridor project provides the City with a way to take advantage of cost efficiencies, minimize disruption to the community, and better schedule/execute its work. By ensuring that sanitary assets are kept in a state of good repair (i.e. fair or better condition), it allows the City to plan ahead for sanitary and associated corridor replacements, as opposed to reacting to poor condition assets.

It should be noted that the current funding is close to adequate to meet the City's LOS targets over a 10-year period, however, some of that budget will likely be allocated towards corridor replacement projects, that may result in some candidates for replacement being accelerated in schedule to accommodate the combined corridor work. The City should continue its method of corridor bundling, so that it can continue to take advantage of the cost savings and project efficiencies of bundled work. The goal is to avoid new roads from being excavated to replace sewers.

When analyzing the 25-year time-period, it was noted that a lower equivalent annual cost is required to meet the City's target LOS over this longer time-period. This indicates that the City has more needs in the medium term (i.e. the 10-year forecast period) than the medium to long-term (25-year period). This is evident from Figure 4-14, which illustrates a larger amount of needs in the first year of the analysis period, representing a backlog.

The City has also completed an analysis of needs over a 50-year time period. Note that this analysis indicated that current funding should be adequate to support the 50-year asset needs.

Note that for vertical assets (pumping stations), the lifecycle models indicate that interventions for these facilities are on a 25-year frequency. The lifecycle analysis in this AMP indicated that no needs were anticipated in the scenario periods. The City should continue to budget for anticipated needs on 25 year frequencies beyond the analysis period.

It is recommended that the City proceed with the budget detailed in Scenario 3 (Meet 100% LOS in 10-years), which is an investment of $1.0M annually. This will ensure that service levels are sustained in both the medium and long-term. It will also address the backlog in the forecast period.

4.3. COMBINED SEWER COLLECTION SYSTEM

Part of the City's wastewater collection systems is the combined sewer collection system. Combined sewers are sewers that convey both storm and sanitary flows. Because of this, it is important that these flows are conveyed without causing damage to properties through flooding or the natural environment through combined sewer overflow (CSO) events.

Figure 4-15: Asset Classes of the Combined Sewer Collection System

This section documents the current state of combined sewers, the LOS provided to the community, the lifecycle activities performed on the sewer system, and the financial strategy required to deliver services associated with combined sewers.

4.3.1 State of Infrastructure

Asset Inventory and Valuation

The replacement cost for the combined sewer collection system is approximately $197.0 million and is summarized in Figure 4-16 and Table 4-10.

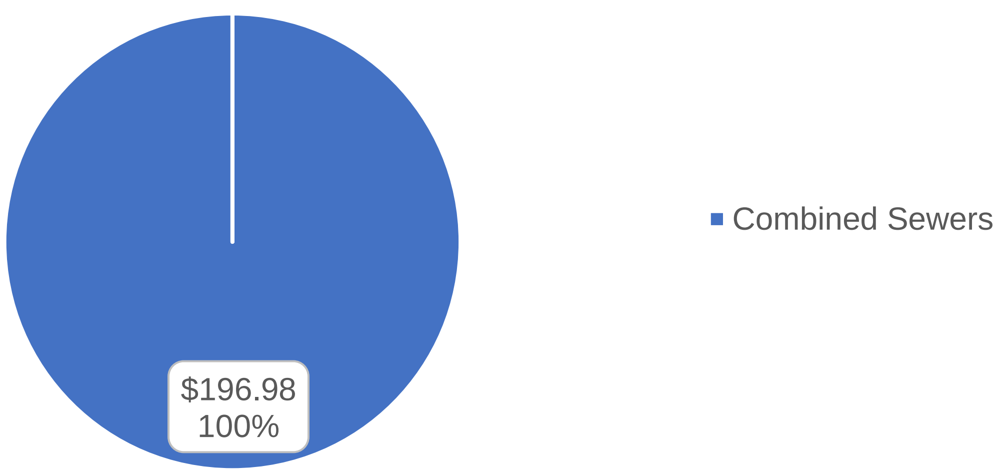

Figure 4-16: Combined Sewer Collection System Valuation ($M)

Table 4-10: Combined Sewer Collection System Asset Quantities and Replacement Values

Category	Asset Category	Asset Class	Quantity	Replacement Cost
Combined Sewer Collection System	Linear	Combined Sewers	56.40 km	$196.98M

Age Summary

The average age of assets compared to the average estimated service lives for the combined sewer collection system is provided in Figure 4-17. Presenting the asset portfolio in this manner provides a high-level understanding of the average age of combined sewer assets, relative to their lifecycles, which in turn can give an idea of overall condition based on age. For the Combined Sewers asset class, a comparison of average age to the average estimated service lives is also provided at a more granular level (by material type) in Figure 4-18. Note that this figure illustrates that combined sewers of the brick and stone material have surpassed their average estimated service lives by 13 and 21 years respectively.

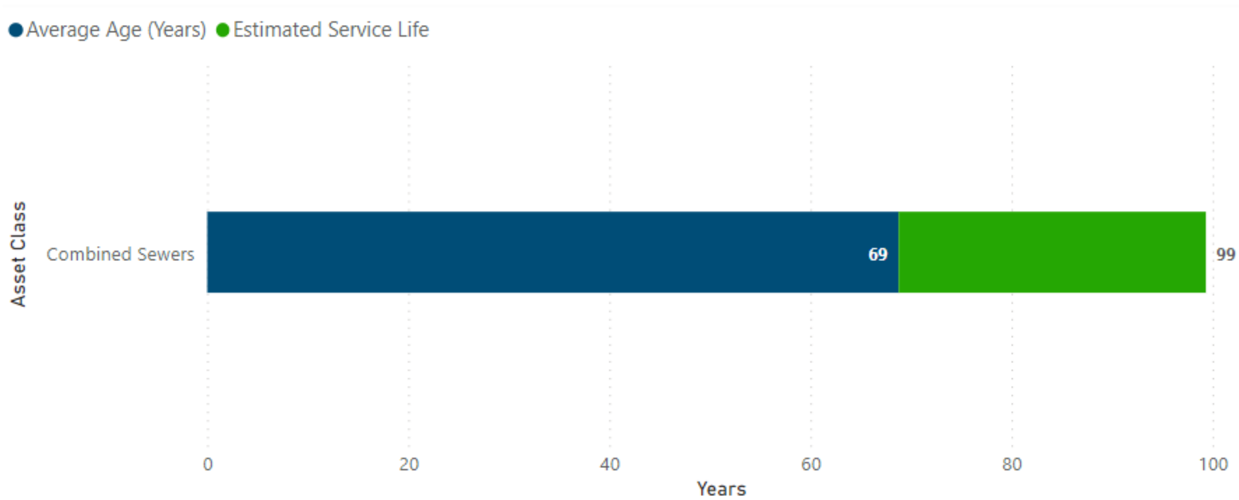

Figure 4-17: Combined Sewer Collection System Average Age as a Proportion of Average ESL

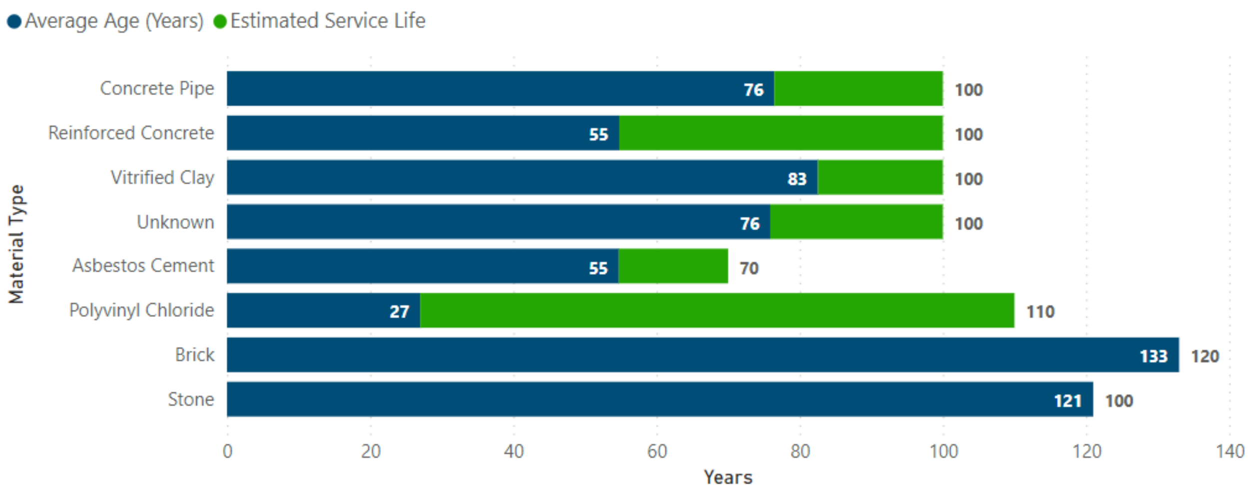

Figure 4-18: Combined Sewers Average Age as a Proportion of Average ESL by Material

The pipes within the combined sewer network consist of various material types, each with a unique service life value attributed to it. The material type, service life and remaining lifespan of each combined sewer material type is summarized in Table 4-11.

Table 4-11: Combined Sewer Service Life

Material	Length (km)	Percentage of Network (%)	Service Life (Years)	Average Age (Years)	Remaining Service Life (Years)
Concrete Pipe	19.56	34.69%	100	70	30
Reinforced Concrete	14	24.83%	100	54	46
Vitrified Clay	13.7	24.30%	100	84	16
Unknown	2.84	5.04%	75	78	0
Asbestos Cement	2.78	4.93%	70	55	15
Polyvinyl Chloride	2.74	4.86%	110	29	81
Brick	0.42	0.74%	120	133	0
Stone	0.35	0.62%	100	121	0

The distribution of assets by construction date is provided in Figure 4-19. It illustrates that the largest historical investment in combined sewers was made between 1965 and 1969. Note that the City has generally stopped the construction of combined sewers since the 1970s, however, the figure below illustrates that some combined sewers have installation dates later than this time. This generally occurs due to the way in which combined sewers are defined. Sewers that are downstream of other combined sewers must be considered combined, even if they are physically separated, since they will carry water from an upstream combined sewer. Until such time upstream sewers are separated, at that time they will be considered separated. Therefore, some sewers installed past the 1970s may be considered combined, even if they are physically separated.

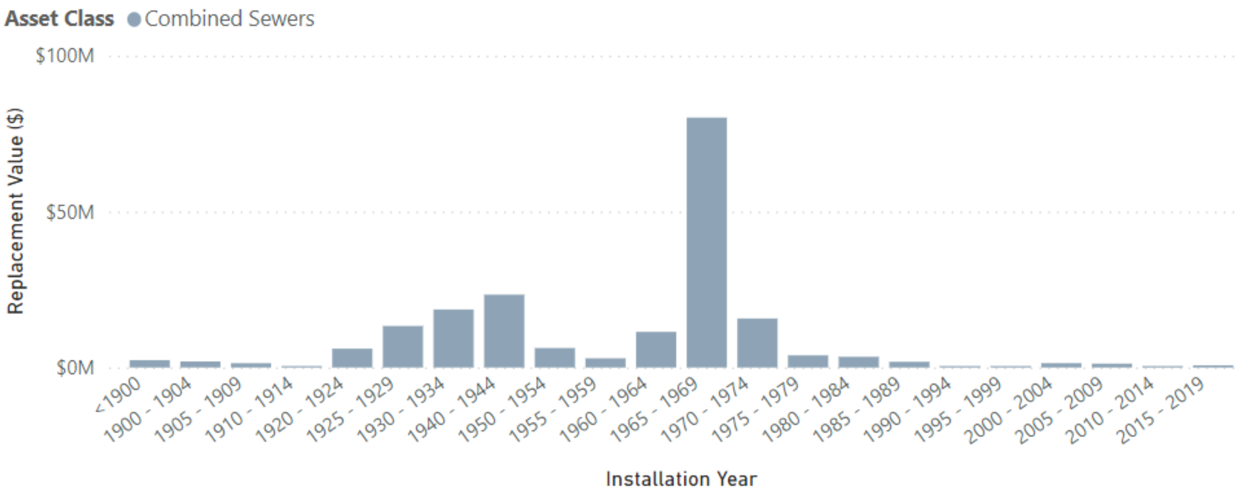

Figure 4-19: Combined Sewer Collection System Construction Date Distribution

Asset Condition

The City has been assessing the condition of combined sewers via CCTV inspections. Condition grades were assigned to each sewer using the findings from the CCTV inspections, using the NAASCO pipeline assessment certification program (PACP) standardized condition rating scores. These condition scores are developed by completing CCTV inspections of pipes and assigning scores to pipes based on the structural defects, and blockages observed during the inspections. PACP scores range from 0 - 5 and is then converted to a 1-5 score in the data base (with 1 indicating good condition and 5 indicating poor condition).

Table 4-12 presents the logic used to convert PACP grades and life consumed values into a condition category. The condition distribution by replacement value is provided in Figure 4-20 and Figure 4-21.

Table 4-12: Combined Sewer Collection Condition Ratings

Category	Life Consumed	Condition Ratings Combined Sewers (PACP & Blockage Grades)
Very Good	0% to 25%	1
Good	25% to 50%	2
Fair	50% to 75%	3
Poor	75% to 100%	4

Category	Life Consumed	Condition Ratings Combined Sewers (PACP & Blockage Grades)
Very Poor	>100%	5

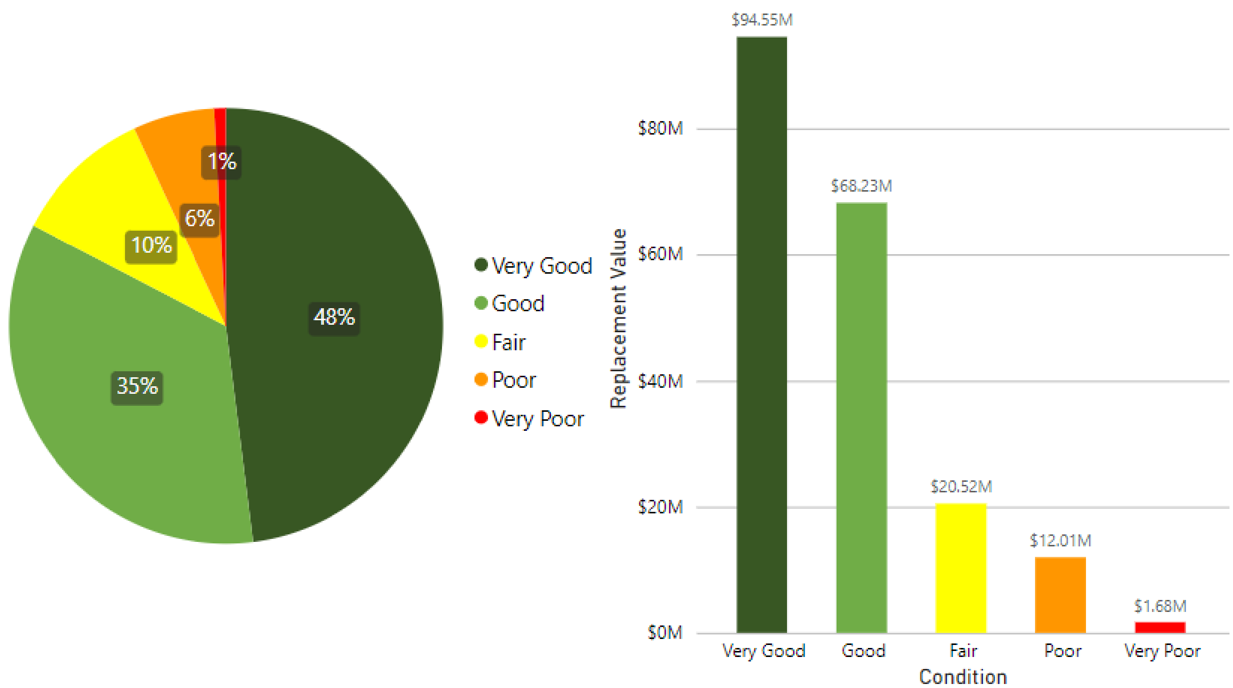

Figure 4-20: Combined Sewer Collection System Overall Condition

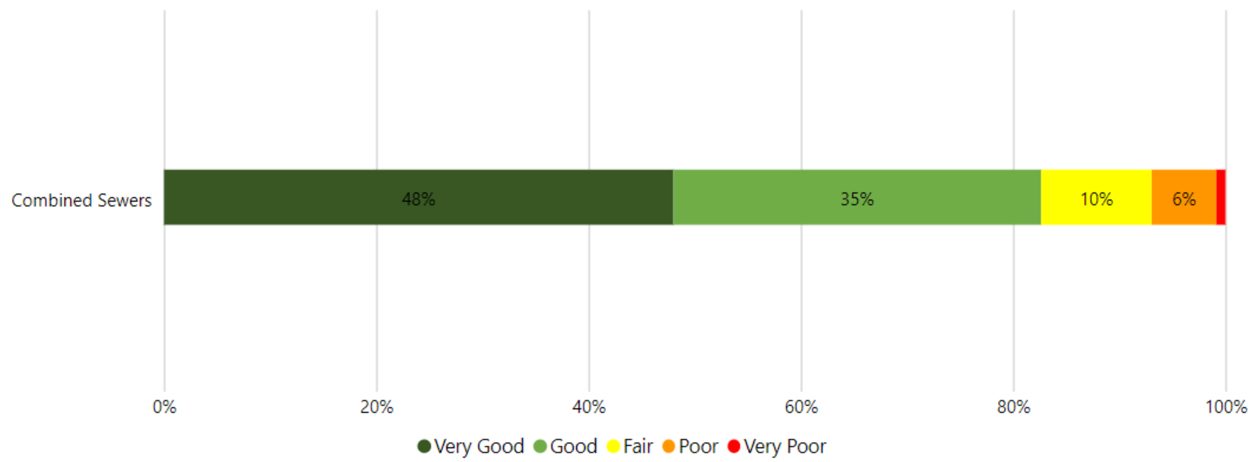

Figure 4-21: Combined Sewer Collection System Condition Distribution by Replacement Value

Data Sources and Confidence

The data sources to support this state of the infrastructure analysis, as well as the other AM planning analyses required to complete this AMP is provided in Table 4-13.

Table 4-13: Combined Sewer Collection System - Condition Data Collection

Asset Class	Condition Data Collection Technique	Frequency
Combined Sewers	▪ CCTV inspection completed to collect condition data as per the PACP standard.	▪ Annually, scope of inspections based on needs.

The data completeness and confidence values for the aforementioned data is provided in Table 4-14.

Table 4-14: Combined Sewer Collection System - Data Confidence

Asset Class	Completeness	Confidence	Comments
Combined Sewers	**Good**	**High**	5% are missing inspection year. Approx. 4% of assets missing condition data and 5% of assets have unknown pipe material.

4.3.2 Levels of Service

The City's goal is to provide fair or better wastewater collection services to all its residents and businesses. This is achieved by minimizing odours and sewer backups, ensuring all assets remain in a state of good repair by performing regular maintenance, and minimizing environmental impacts by meeting Ministry of the Environment, Conservation, and Parks (MECP) requirements, all while optimizing lifecycle costs.

The community and technical LOS for the wastewater collection system are shown in Table 4-15 and Table 4-16 below. The measures are categorized in two types: Mandatory LOS measures as per O. Reg. 588/17, and foundational measures selected by the City.

(orange)	Represents a mandatory LOS measure as per O. Reg. 588/17
(grey)	Represents a foundational measure selected by the City

Note that the Combined Sewer System provides services that are aligned with both the Sanitary Sewer Collection System and Storm Sewer Collection System. As a result, some of the mandated O.Reg. 588/17 LOS measures are listed in both the Sanitary Sewer Collection System LOS measures, as well as the Combined Sewer Collection System LOS measures below.

Table 4-15: Combined Sewer Collection System Community Levels of Service

Subservice	Community Measures	Service Attributes	Current Performance
Combined Sewer Collection System	Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes.	Reliable	No combined sewers allowed in new construction design. The City has constructed overflow structures that collect excess flow to ensure that backups into homes are minimized or prevented.
	Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches.	Reliable	The City has not experienced any overflows in habitable areas or beaches.
	Sewer backups minimized	Reliable, Operational, Environmentally Sustainable	The technical LOS measures for the reliable, operational and environmentally sustainable attributes indicate that the system is maintained in a state where sewer backups are minimized.
	Wastewater does not harm the environment	Environmentally Sustainable	At present, the City is working towards eliminating combined sewers wherever possible, which will result in a positive environmental impact in the long run. The City's current environmental technical objectives indicate that CSO events are still prevalent, and over 50km of combined sewers still exist in the network, indicating that it

Subservice	Community Measures	Service Attributes	Current Performance
			is moderately meeting its environmental objectives, but is still working towards further reducing its environmental impact.
	Adverse odours are minimized	Quality	Odour complaints are addressed on a case-by-case basis, the other service attributes also indirectly address odour issues by providing reliability, etc. At present, the City does not have a technical metric established for this community measure.

Table 4-16: Combined Sewer Collection System Technical Levels of Service

Service Attribute	Performance Measure	Current Performance
Reliable	The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system.	11 events for 15,471 properties
	Percentage of combined sewers that are in fair or better condition	93%
Operational	Annual number of unplanned flushing events for combined sewers	0
Environmentally Sustainable	Length (km) of combined sewers in the network	56.4km
	Annual number of CSO events	11
	Annual number of CSO events that meet MECP requirements	11 (100%)

4.3.3 Lifecycle Management Strategy

Lifecycle Activities

For the City to provide combined sewer collection services and maintain LOS, certain lifecycle activities are performed on the combined sewers. These include non-infrastructure solutions such as developing various plans and performing condition assessments; maintenance activities to repair and clean assets; spot repairs to rehabilitate them; sewer separation; asset and material disposal; and expanding and upgrading assets to support growth. Table 4-17 summarizes the lifecycle activities performed on combined sewers.

The City is generally working towards eliminating combined sewers, as they present some risks that are not present in a separated system. The main risks include increased chance of flooding during heavy precipitation events, as well as combined sewer overflows which cause excess stormwater and sanitary flows to be discharged into water bodies.

Table 4-17: Combined Sewers Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, capacity studies, AMPs)	As required
	Wastewater model	As required, based on needs
	CCTV Inspections	Annual, scope of inspections is based on needs
	Water usage reduction incentives	Ongoing
Operations and Maintenance	Spot Repairs	As required
	Lateral and maintenance hole repairs	As required
	Flushing	Prior to CCTV, based on identified issues, and during construction and commissioning
Rehabilitation	N/A	N/A
Replacement	Full pipe replacement, replace with separated sewers	When asset reaches poor condition
	Maintenance hole and lateral replacement	Coordinated with combined sewer replacement

Lifecycle Activity	Description	Frequency
Disposal	Removed as part of the project or abandoned	Coordinated with combined sewer replacement
Expansion/Service Changes	Pipe upsizing	Based on growth, modelling and studies
	Separation of combined sewers into dedicated storm and sanitary sewers.	Based on various studies and plans or coordinated with planned replacements
	New subdivisions	Through development
	Coordination with other related works	Based on corridor analysis

4.3.4 Funding the Lifecycle Activities

The City uses the lifecycle strategies described in Section 4.3.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Combined Sewer assets was defined as the length of combined sewers in the network. The City is working towards separating all combined sewers; as such, a reinvestment rate analysis was completed to determine the annual investment to achieve this LOS in various years. The results are provided in Table 4-18.

Table 4-18: Combined Sewer Separation

	Current Anticipated Budget	Scenarios		
Years to Achieve LOS	56	10	25	50
Annual Separation Rate	1.78%	10.00%	4.00%	2.00%
Annual Investment	$1.50M	$8.42M	$3.37M	$1.68M
Annual Length Separated (m)	975	5,470	2,188	1,094

The City's primary LOS is related to separating combined sewers. Therefore, only results from Scenario 1 and Scenario 5 are reported for condition-based needs.

Scenario 1: Anticipated Budget – Condition Needs

The current planned budget was analyzed to understand asset performance and forecast any immediate needs the City might have. The current anticipated investments, $1.5M annually, resulted in the performance forecast illustrated in Figure 4-22.The percentage of assets in fair or better condition remains around 93% over the 10-year forecast period.

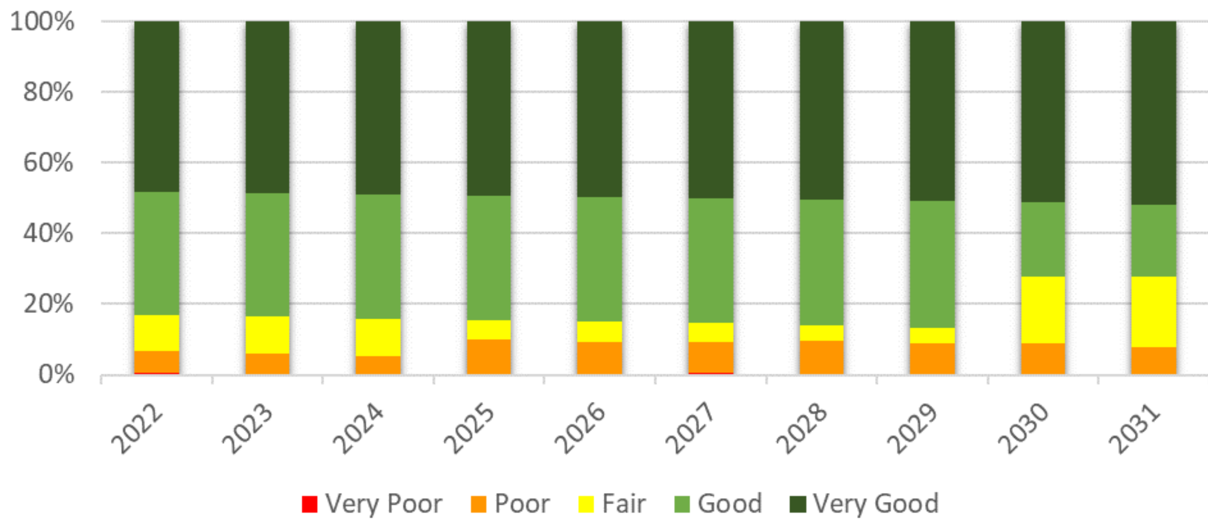

Figure 4-22: Combined Performance Forecast with Anticipated Budget

Scenario 5: Backlog Analysis – Condition Needs

The backlog analysis indicated that a $14.0M (4.5km) backlog is present in Combined Sewer Collection assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 4-23.

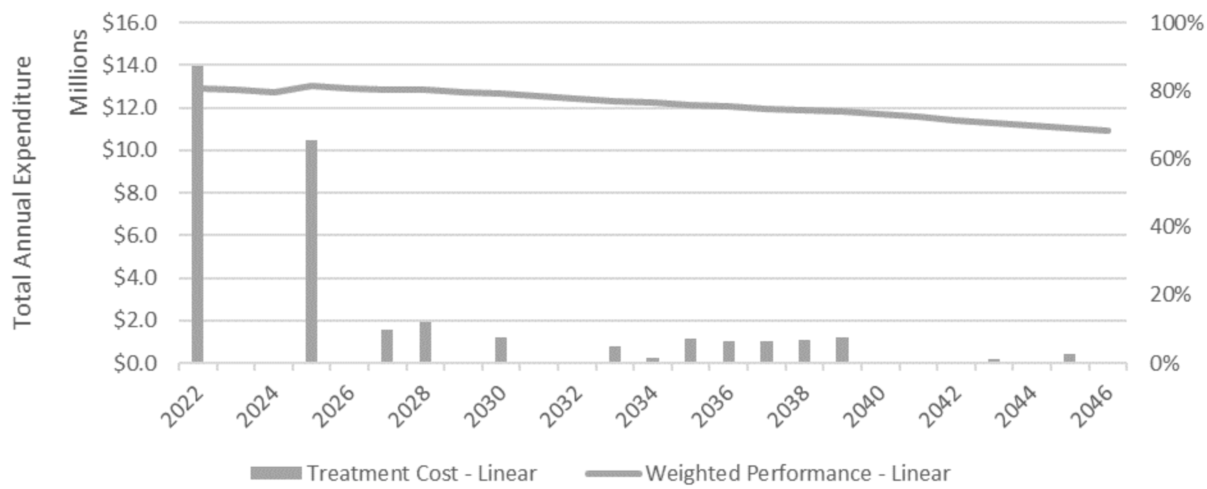

Figure 4-23: Combined Sewer Condition Backlog Analysis

4.3.5 Recommendations

The primary LOS objective of the City's Combined Sewers is to separate (i.e. eliminate) all combined sewers within the City. Based on current anticipated budget forecasts, the City is projected to achieve this proposed LOS target in 56 years.

The equivalent annual costs increase drastically if the time required to meet these targets is accelerated to 10 or 25 years. Furthermore, generally the City is able to provide a high LOS under the current budget scenario. In order to provide this LOS, the City enacts a preventive flushing program, in which it completes routine flushing to areas that are deemed to be "trouble spots" in the network. Even with this preventive maintenance effort, the City still experiences some unplanned flushing events. The preventive flushing program helps to minimize the number of unplanned flushing events that are required. As more combined sewers are separated, the City can expect to experience a reduction in unplanned flushing events, and an eventual scaling back of its preventive flushing program.

The City's current practices which allow them to bundle linear projects under corridor work mean that the roads budget typically dictates the sewer separation budget (i.e. road needs are drivers of corridor projects). The location of combined sewers does not always align with the location of roads that require intervention. As a result, the City's anticipated road works will achieve separation of some (but not all) combined sewers. Nevertheless, due to the overall good condition of combined sewers, this practice is acceptable, since the City does not have a significant need to increase budgets and replace combined sewers due to condition concerns.

The City notes, however, that separating combined sewers will result in a reduction of CSOs, which could improve other LOS measures.

It is recommended that the City continue with its current planned spending (refer to Scenario 1) to separate combined sewers, which will allow the City to continue to separate combined sewers as part of its corridor replacement program. The City should continue to monitor CSO events to determine if they are increasing, decreasing or remaining consistent over time. If CSO events are increasing, then the City should consider increasing its investment to accelerate the separation of combined sewers. In the meantime, the City does not have a substantial condition-based need to increase combined sewer replacements (and separations) and should continue monitoring the status of its network.

4.4. STORM SEWER COLLECTION SYSTEM

The City of Cornwall is responsible for managing stormwater in order to protect all properties and the environment from flood water through the storm sewer collection system. To achieve this, the City maintains and replaces its stormwater assets to keep them in a state of good repair.

Figure 4-24: Asset Classes of the Storm Sewer Collection System

This section documents the current state of stormwater collection assets, the LOS provided to citizens, the lifecycle activities performed on the assets, and the financial strategy required to deliver stormwater collection services.

4.4.1 State of Infrastructure

Asset Inventory and Valuation

The replacement cost for the storm sewer collection system is approximately $207.5 million and is summarized in Figure 4-25 and Table 4-19.

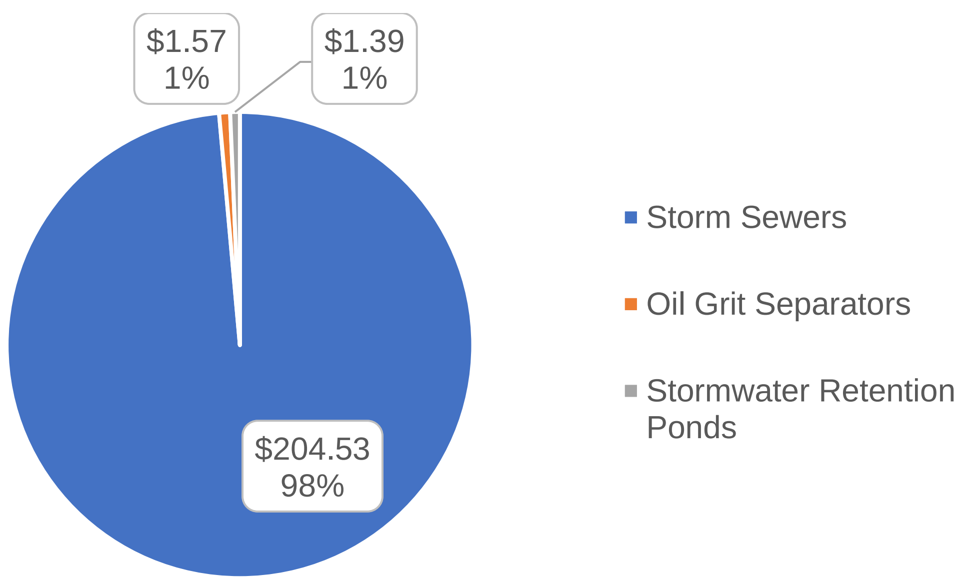

Figure 4-25: Storm Sewer Collection System Valuation ($M)

Table 4-19: Storm Sewer Collection System Asset Quantities

Category	Asset Category	Asset Class	Quantity	Replacement Cost
Storm Sewer Collection System	Linear	Storm Sewers	145.58 km	$204.53M
	Vertical	Oil Grit Separators	15	$1.57M
		Stormwater Retention Ponds	9 Facilities	$1.40M

Age Summary

The average age of assets compared to the average estimated service lives for the storm sewer collection system is provided in Figure 4-26. Presenting the asset portfolio in this manner provides a quick snapshot of where the storm assets generally are in their lifecycle, which in turn can give an idea of overall condition based on age. For the Storm Sewers asset class, a comparison of average age to the average estimated service is provided at a more granular level (by material type) in Figure 4-27.

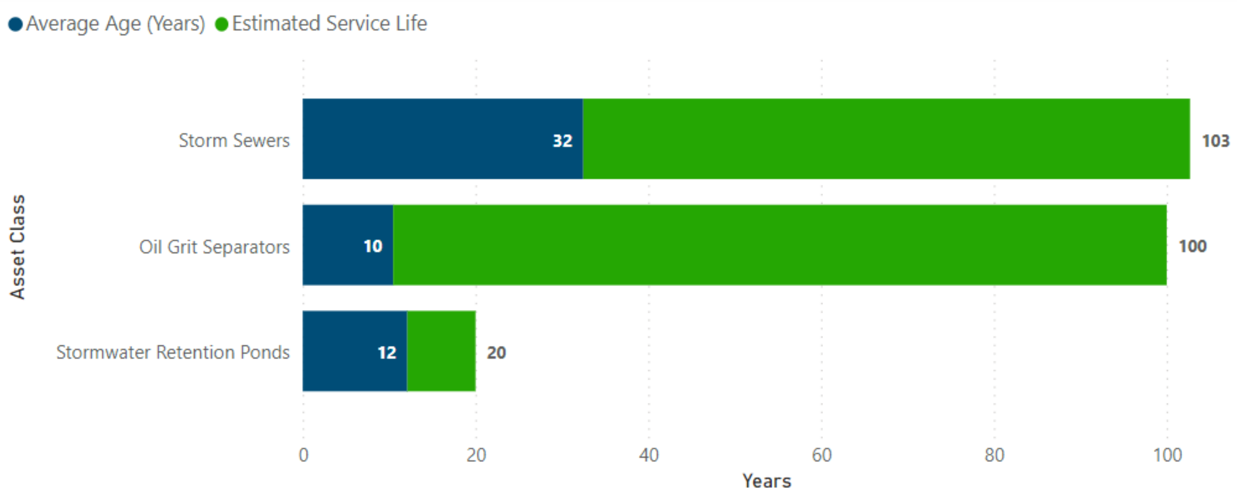

Figure 4-26: Storm Sewer Collection System Age as a Proportion of Average ESL

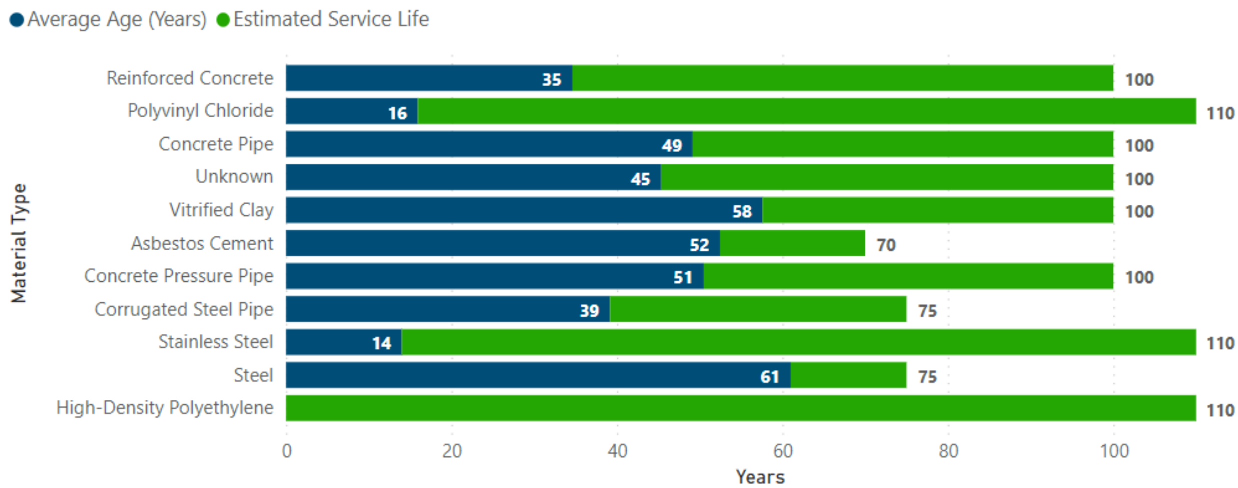

Figure 4-27: Storm Sewers Average Age as a Proportion of Average ESL by Material

The pipes within the storm sewer network consist of various material types, each with a unique service life. The material type, service life and remaining lifespan of each storm sewer material type is summarized in Table 4-20.

Table 4-20: Storm Sewer Service Life

Material	Length (km)	Percentage of Network (%)	Service Life (Years)	Average Age (Years)	Remaining Service Life (Years)
Reinforced Concrete	77.47	53.22%	100	36	64
Polyvinyl Chloride	34.73	23.86%	110	18	92
Concrete Pipe	22.33	15.34%	100	48	52
Unknown	7.36	5.06%	75	41	34
Vitrified Clay	1.58	1.09%	100	56	44
Asbestos Cement	0.85	0.58%	70	53	17
Concrete Pressure Pipe	0.73	0.50%	100	52	48
Corrugated Steel Pipe	0.46	0.32%	75	35	40
Stainless Steel	0.03	0.02%	110	14	96
Steel	0.02	0.01%	75	61	14
High-Density Polyethylene	0.01	0.01%	110	0	110

The distribution of assets by construction date is provided in Figure 4-28. The construction of dedicated storm sewers generally increased from the 1960s and beyond, since the City made efforts to eliminate the new construction of combined sewers.

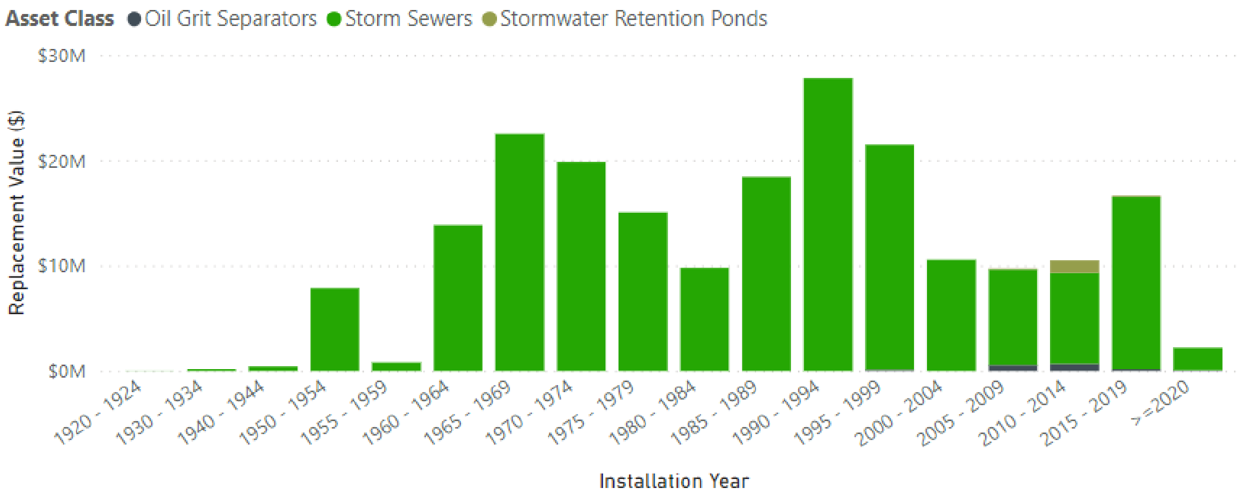

Figure 4-28: Storm Sewer Collection System Construction Date Distribution

Asset Condition

The City has been assessing the condition of storm sewers via CCTV inspections. Condition grades were assigned to each sewer using the findings from the CCTV inspections, using the NAASCO pipeline assessment certification program (PACP) standardized condition rating scores. For assets without condition data, life consumed was used to determine asset condition. Note that for oil grit separators and stormwater retention ponds, the City completes regular sediment surveys, but data has not been digitized and paired to its asset inventory, therefore a life consumed approach was used to evaluate asset condition. Table 4-21 presents the logic used to convert PACP grades and age as a proportion of remaining useful life into a condition rating. The condition distribution by replacement value is provided in Figure 4-29 and Figure 4-30.

Table 4-21: Storm Sewer Collection Condition Ratings

Category	Life Consumed	Condition Ratings	
		Storm Sewers (PACP & Blockage Grades)	Oil Grit Separators, Stormwater Retention Ponds
Very Good	0% to 25%	1	Life Consumed is the metric used to evaluate condition for these asset classes
Good	25% to 50%	2	
Fair	50% to 75%	3	
Poor	75% to 100%	4	
Very Poor	>100%	5	

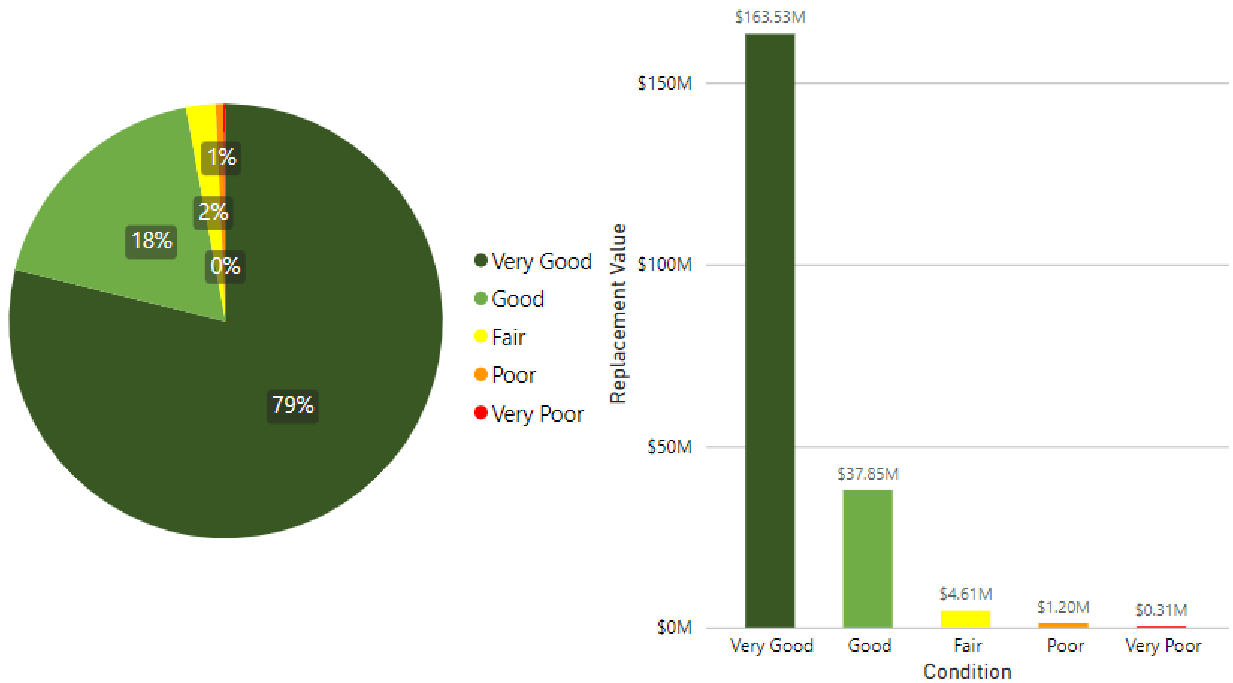

Figure 4-29: Storm Sewer Collection System Overall Condition

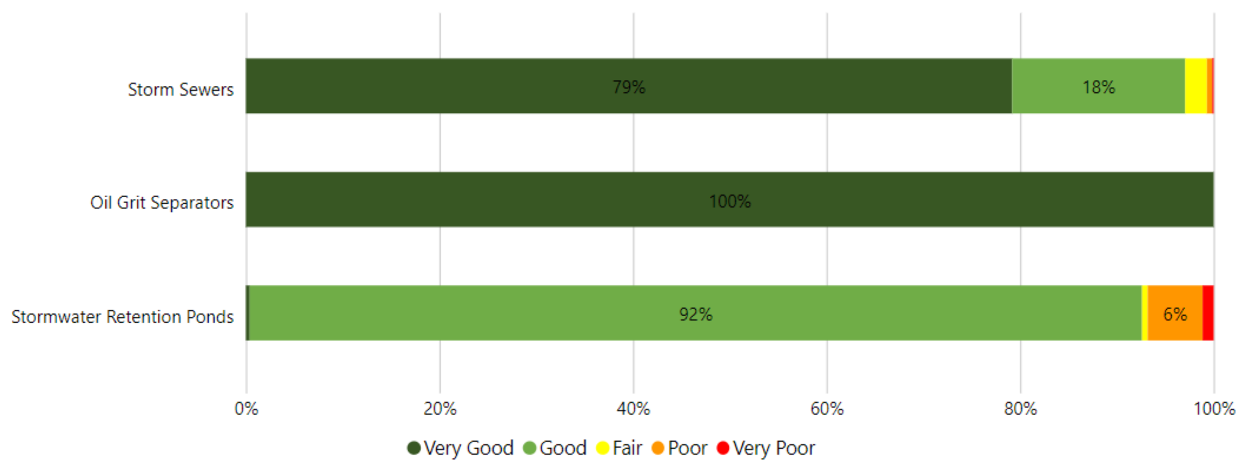

Figure 4-30: Storm Sewer Collection System Condition Distribution by Replacement Value

Data Sources and Confidence

The data sources to support this state of the infrastructure analysis, as well as the other AM planning analyses required to complete this AMP is provided in Table 4-22.

Table 4-22: Storm Sewer Collection System - Condition Data Collection

Asset Class	Condition Data Collection Technique	Frequency
Storm Sewers	▪ CCTV inspection completed to collect condition data as per the PACP standard.	▪ Annually, 10% of network inspected per year
Oil Grit Separators	▪ Sediment surveys completed to assess condition	▪ Annually
Stormwater Retention Ponds	▪ Bathymetric surveys completed to assess sediment levels	▪ Annually

The data completeness and confidence values for the aforementioned data is provided in Table 4-23.

Table 4-23: Storm Sewer Collection System - Data Confidence

Asset Class	Completeness	Confidence	Comments
Storm Sewers	**Good**	**High**	11% are missing inspection year. Approx. 9% of assets missing condition data and 5% of assets have unknown pipe material.
Oil Grit Separators	**Fair**	**Medium**	Condition data not paired to GIS (sediment levels). Data completeness is fair, and therefore data confidence is affected.
Stormwater Retention Ponds	**Good**	**High**	Condition data not paired to GIS (sediment levels).

4.4.2 Levels of Service

The City's goal is to provide a reliable, operational, and environmentally sustainable storm sewer collection system to all its residents and businesses. This means protecting all properties from flood waters, ensuring all assets remain in a state of good repair by performing regular maintenance, and minimizing environmental impacts, all while optimizing lifecycle costs.

The community and technical LOS for the sanitary sewer collection system are shown in Table 4-24 and Table 4-25.

The measures are categorized in two types: Mandatory LOS measures as per O. Reg. 588/17, and foundational measures selected by the City.

(orange)	Represents a mandatory LOS measure as per O. Reg. 588/17
(grey)	Represents a foundational measure selected by the City

Table 4-24: Storm Sewer Collection System Community Levels of Service

Subservice	Community Measures	Service Attributes	Current Performance
Storm Sewer Collection System	Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system.	Scope	Urban areas protected from ROW/ infrastructure flooding through urban ditch system or underground storm collection, some with defined outlets. Most rural areas protected from flooding through provision of municipal drains or rural ditch systems, some with defined outlets
	Property impacts from flooding are minimized	Reliable, Operational	The technical LOS measures indicate that the system has a high degree of reliability. The system's operational objectives also indicate that the City has kept its infrastructure in state that minimizes the impacts of flooding.
	Transportation impacts from flooding are minimized	Reliable, Operational	The technical LOS measures indicate that the system has a high degree of reliability. The system's operational objectives also indicate that the City has kept its infrastructure in state that minimizes the impacts of flooding.
	Environmental impacts from flooding are minimized	Reliable, Operational, Environmentally Sustainable	The technical LOS measures indicate that the system has a high degree of reliability. The system's operational objectives also indicate that the City has kept its infrastructure in state that minimizes the impacts of flooding.

Table 4-25: Storm Sewer Collection System Technical Levels of Service

Service Attribute	Performance Measure	Current Performance
Scope	Percentage of properties in municipality resilient to a 100-year storm.	99%
	Percentage of the municipal stormwater management system resilient to a 5-year storm.	100%
Reliable	Percentage of storm sewers that are in fair or better condition	99%
	Percentage of oil and grit separators that are not past their service life	100%
Operational	% of oil and grit separators with sediment levels that are above their required levels	0%
	% of ponds with sediment levels that are above their required levels[2]	2%

4.4.3 Lifecycle Management Strategy

Lifecycle Activities

For the City to provide storm sewer collection services and maintain LOS, certain lifecycle activities are performed on the storm sewer collection assets. These include non-infrastructure solutions such as developing various plans and performing condition assessments; maintenance activities; asset replacement including maintenance holes and catch basins; asset and material disposal; and expanding and upgrading assets to support growth. Table 4-26 to Table 4-28 summarize the lifecycle activities performed on storm sewers, oil grit separators, and stormwater retention ponds.

[2] Frequency of cleaning was used to determine if ponds were above their sediment levels. The City is in the process of digitizing the sediment data.

Table 4-26: Storm Sewers Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, capacity studies, AMPs)	As required
	Stormwater model	As required, based on needs
	CCTV inspections	Annual, 10-year frequency for entire network (10% of network per year)
	Water usage reduction incentives	Ongoing
	Flood risk reduction program	Ongoing
Operations and Maintenance	Spot repairs	As required
	Catch basin, lateral and maintenance hole repairs	As required Repairs are also completed in conjunction with asphalt resurfacing works
	Flushing	Prior to CCTV, based on identified issues, and during construction and commissioning
Rehabilitation	N/A	N/A
Replacement	Full pipe replacement	When assets reach poor condition/end of service life
	Maintenance hole and catchbasin/ditch inlet replacement	Coordinated with sewer replacement
Disposal	Removed as part of the project or abandoned	Coordinated with sewer replacement
Expansion/Service Changes	Pipe upsizing	Based on growth, modelling and studies
	New subdivisions	Through development
	Replacement of ditches with storm sewers	As needed
	Coordination with other works	Based on corridor analysis

Table 4-27: Oil Grit Separators Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, capacity studies, AMPs)	As required
	Stormwater model	As required, based on needs
	Water usage reduction incentives	Ongoing
	Flood risk reduction program	Ongoing
Operations and Maintenance	Sediment surveys	Annually
	Spot cleaning of sediment	As required
Rehabilitation	N/A	N/A
Replacement	Asset replacement	When assets reach end of service life
Disposal	Removed as part of the project	Coordinated with asset replacement
Expansion/Service Changes	Expansion	Through development

Table 4-28: Stormwater Retention Ponds Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, capacity studies, AMPs)	As required
	Stormwater model	As required, based on needs
	Visual inspections	Annually
	Bathymetric Surveys	As required
	Water usage reduction incentives	Ongoing
Operations and Maintenance	Flood risk reduction program	Ongoing
	Grate and structure cleaning	As required
Rehabilitation	Vegetation removal	As required
	Erosion control	As identified through inspections
	Outlet reconstruction	As identified through inspections
	Outfall reconstruction	As identified through inspections
Replacement	Dredging/Cleanouts	As identified through inspections
Replacement	N/A	N/A
Disposal	Sediment disposal	Coordinated with dredging/cleanouts

4.4.4 Funding the Lifecycle Activities – Linear

The City uses the lifecycle strategies described in Section 4.4.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Storm Collection System Linear assets was defined as the percentage of assets that are in fair or better condition.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3 Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments of $237K annually, resulted in the performance forecast illustrated in Figure 4-31. Under this scenario, the percentage of assets in fair or better condition remains at 99% over the 10-year forecast.

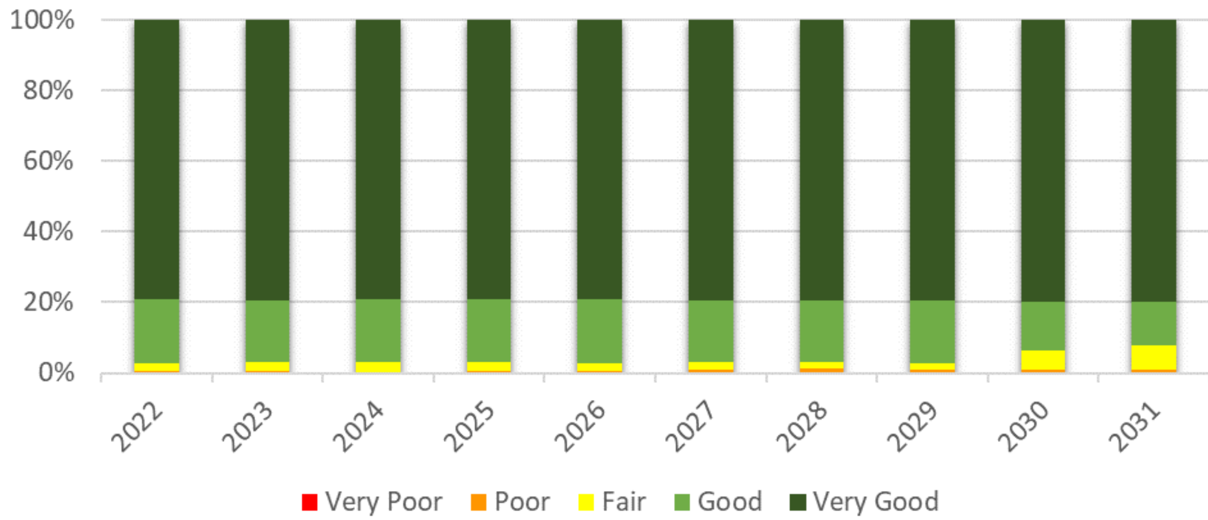

Figure 4-31: Storm Linear Assets Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $237K annually over a 10-year period. Note that this cost is the same as the City's anticipated budget, therefore Figure 4-31 (above) illustrates the performance forecast for this scenario.

Scenario 3: Achieve LOS in 10 Years

The City has set its proposed (target) LOS to ensure that 100% of assets in fair or better condition. The cost to meet this LOS in 10 years was determined to be $400K annually and resulted in the performance forecast illustrated in Figure 4-32.

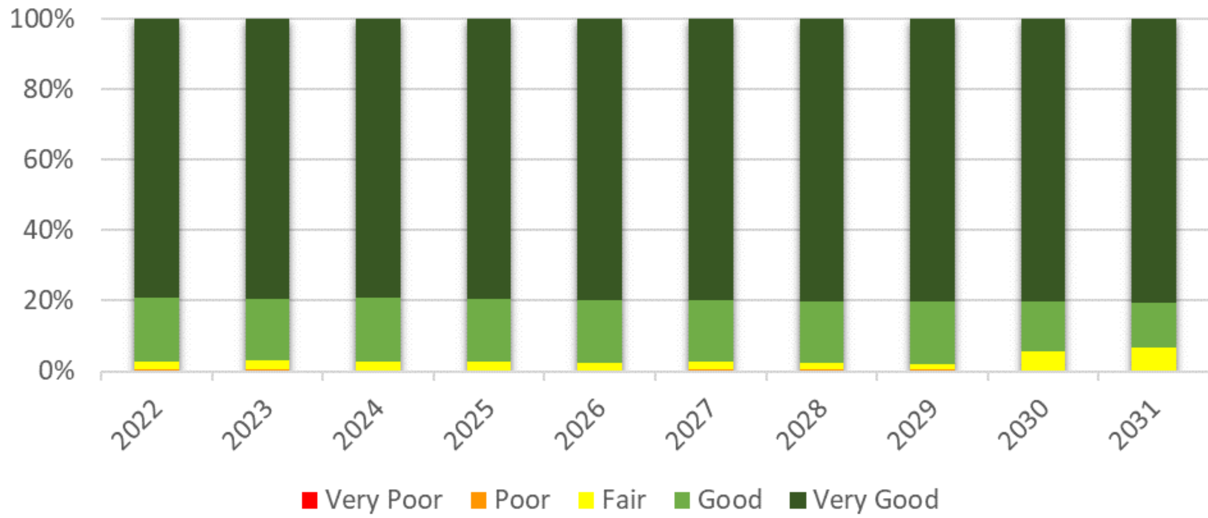

Figure 4-32: Storm Linear Assets Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to achieve the City's proposed LOS in 25 years was determined to be $303K annually and resulted in the performance forecast illustrated in Figure 4-33.

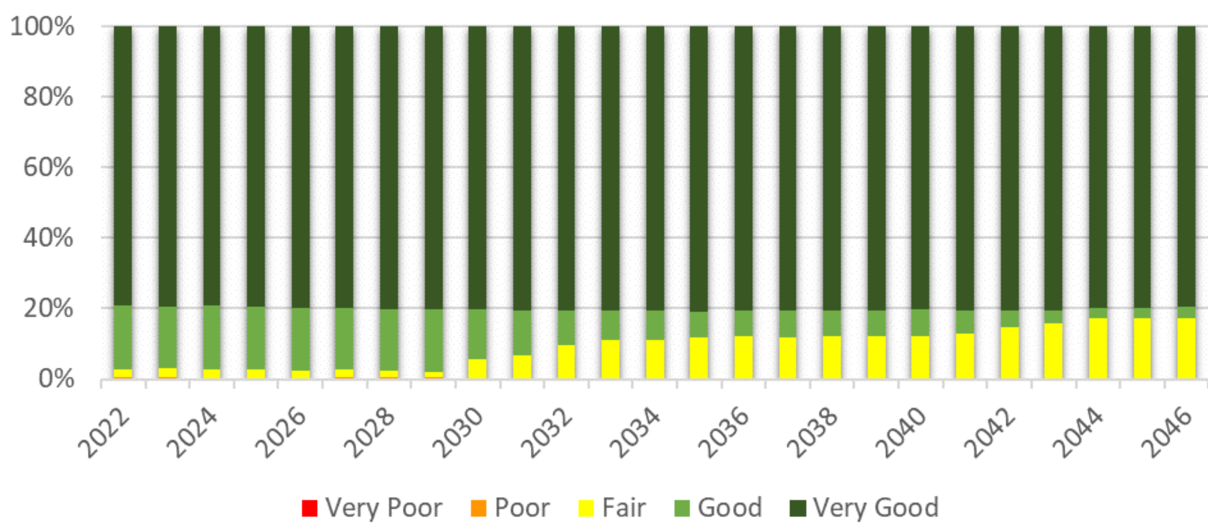

Figure 4-33: Storm Linear Assets Performance Forecast with Cost to Achieve LOS in 25 Years

Scenario 5: Backlog Analysis

The backlog analysis indicated that a $1.4M (1.5km) backlog is present for Linear Storm Sewer Collection assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 4-34.

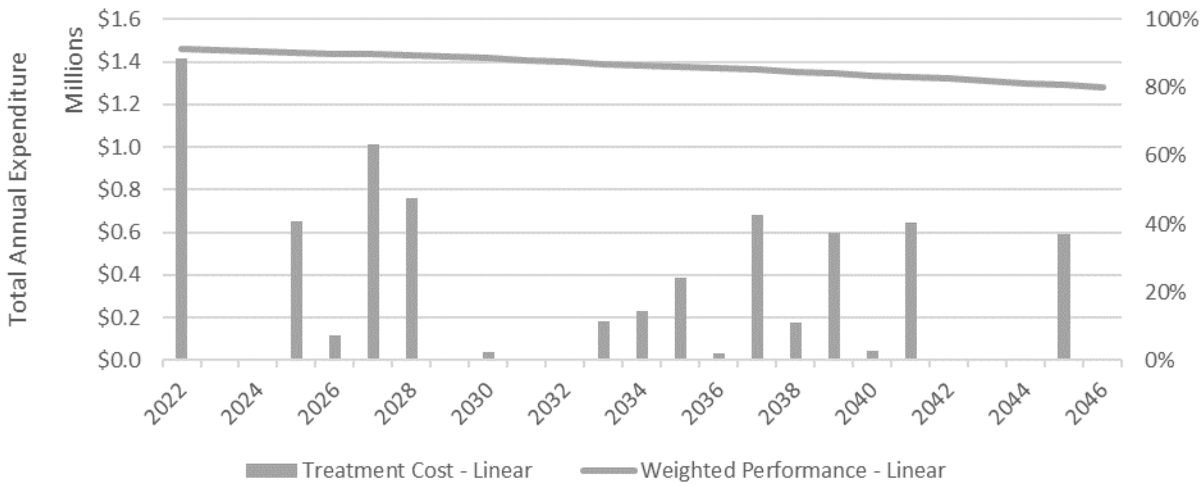

Figure 4-34: Storm Linear Assets Backlog Analysis

4.4.5 Funding the Lifecycle Activities – Vertical

The City uses the lifecycle strategies described in Section 4.4.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Storm Collection System Vertical assets was defined as the percentage of assets that were past their service life (for oil and grit separators). The LOS for ponds were related to sediment levels.

A review of funding scenarios has been analyzed including cost to maintain LOS which is an O.Reg.588/17 requirement. The cost to maintain is the minimum amount municipalities should be spending to ensure that assets do not deteriorate.

Scenario 1: Anticipated Budget

There are no current anticipated capital investments, which resulted in the performance forecast illustrated in Figure 4-35. Under this scenario, the percentage of assets that are not past their service life will be reduced from 99% to 97% over the 10-year forecast period. Note that contrary to other utilities assets, vertical stormwater assets have a LOS to ensure that they are not past their estimated service life. Assets that are past their estimated service life are illustrated as red coloured bars on the figure below. Therefore, under this LOS requirement, the presence of orange-coloured bars is possible while meeting service levels.

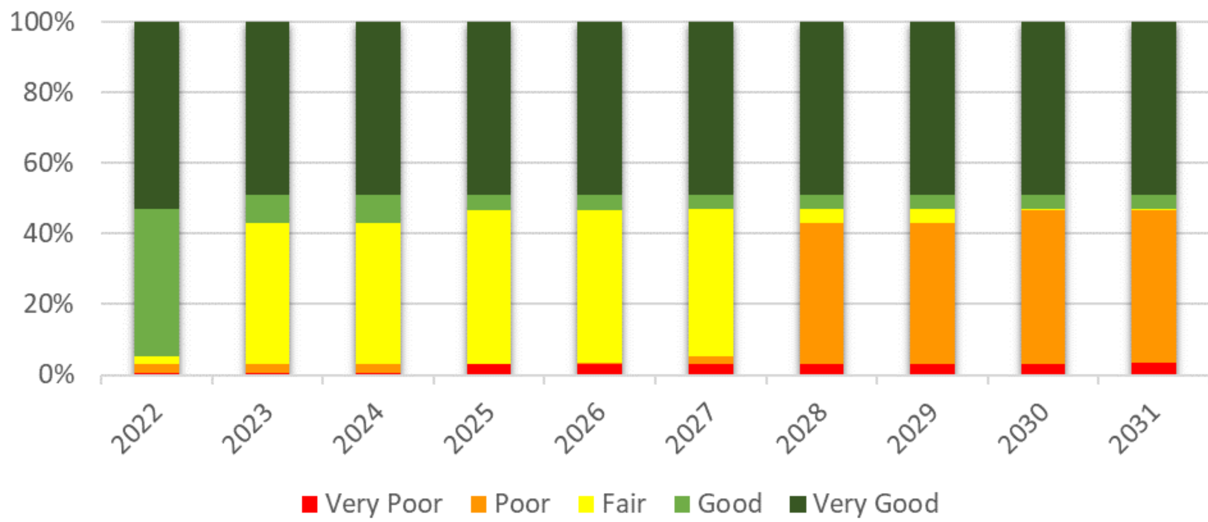

Figure 4-35: Storm Vertical Assets Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $9K annually over a 10-year period and resulted in the performance forecast illustrated in Figure 4-36. The percentage of assets that are not past their service life remains around 99% in this scenario.

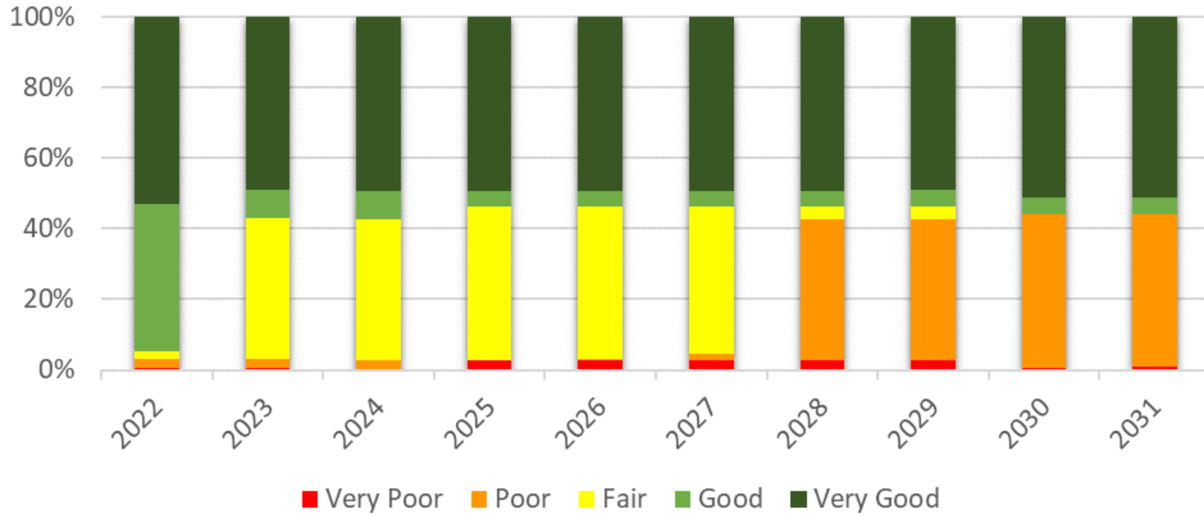

Figure 4-36: Storm Vertical Assets Performance Forecast with Cost to Maintain LOS

Scenario 3: Achieve LOS in 10 Years

The City has set its proposed (target) LOS to ensure that 100% of assets are not past their service life. The cost to meet this LOS in 10 years was determined to be $11K annually and resulted in the performance forecast illustrated in Figure 4-37.

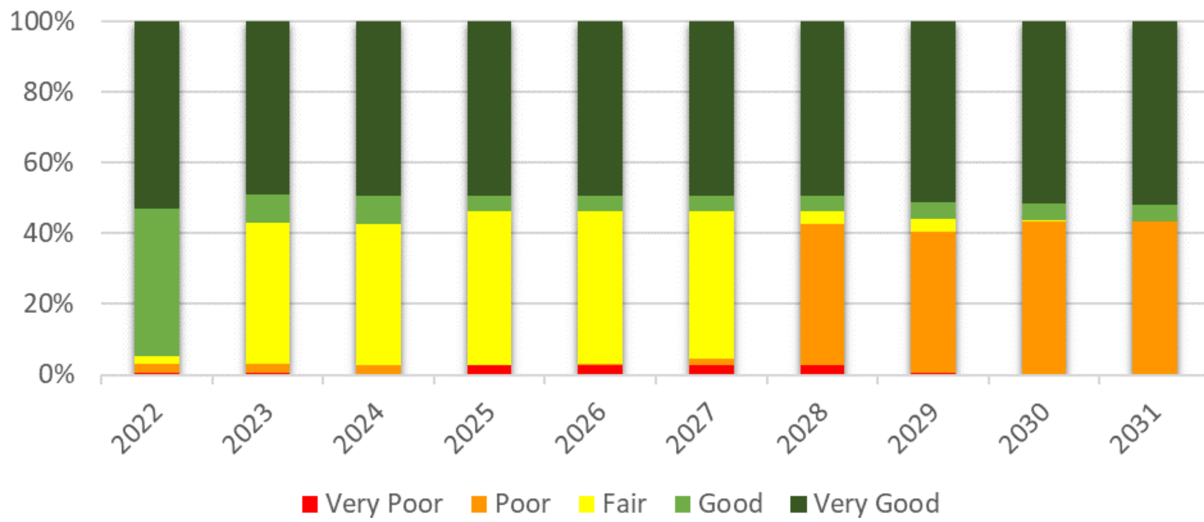

Figure 4-37: Storm Vertical Assets Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to meet the City's proposed LOS over a 25-year period was determined to be $52K annually and resulted in the performance forecast illustrated in Figure 4-38.

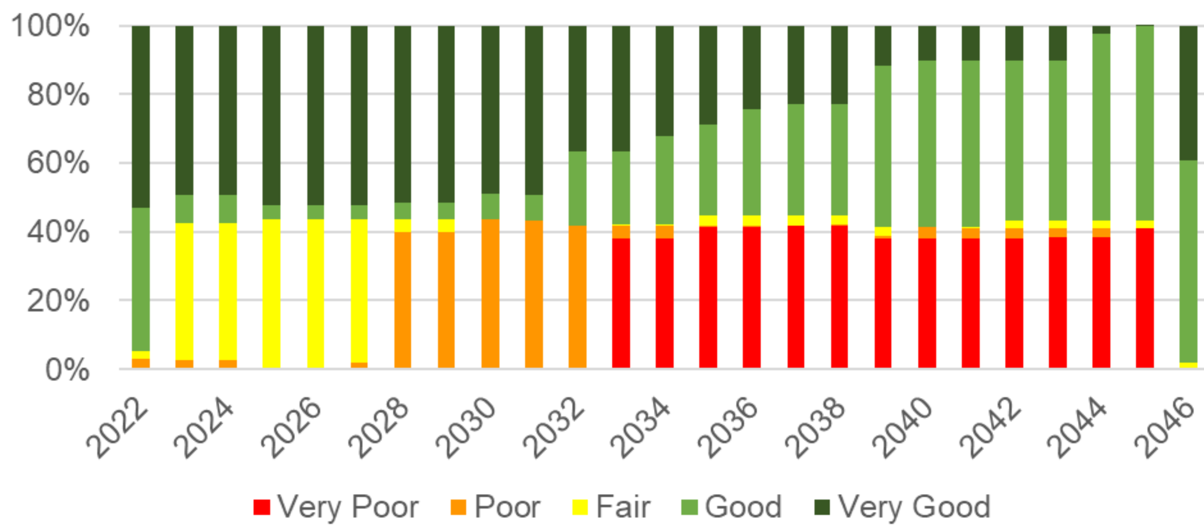

Figure 4-38: Storm Vertical Assets Performance Forecast with Cost to Achieve LOS in 25 Years

Note that in the performance forecast, assets are found to be in poor or very poor condition at various times throughout the forecast analysis. This is due to a significant investment need that occurs in 2033 in the analysis. To handle the significant need, the City has the option to contribute funding to reserves, or to utilize debt financing in order to ensure it has funds available to meet significant needs when they occur.

Scenario 5: Backlog Analysis

The backlog analysis indicated that there was no immediate backlog for Vertical Storm Sewer Collection assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 4-39. Note that this funding is based on the City's condition models. There are instances where events occur that require unplanned reactive works, which the City also keeps an allocation for this in the Operating Budget. Those would not be reflected in this model, since the model can only analyze predictive events, and not unplanned ones.

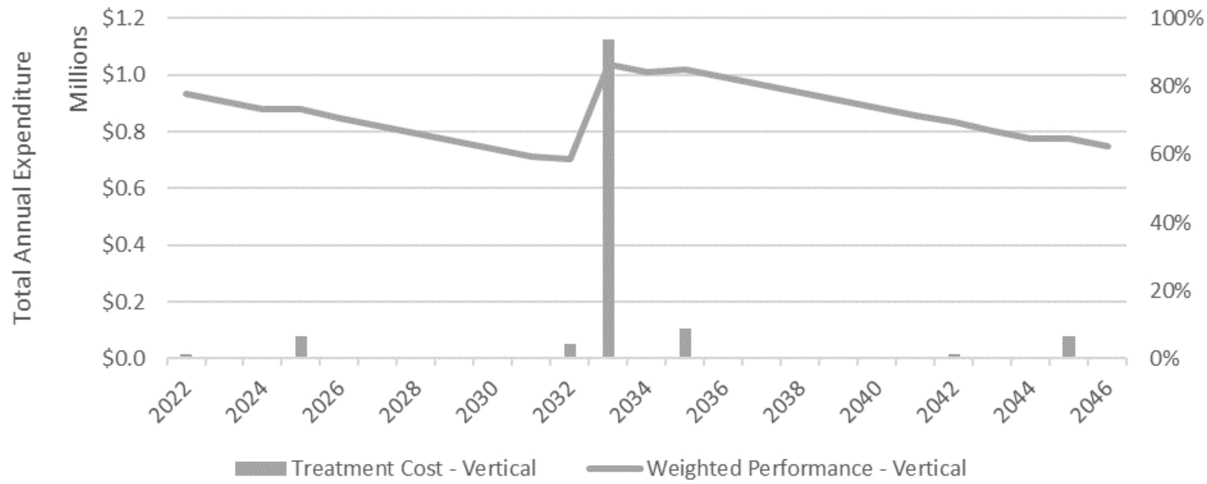

Figure 4-39: Storm Vertical Assets Backlog Analysis

4.4.6 Recommendations

The results of the various scenario analyses indicated that the City's current planned budget is lower than the budget needed to meet its proposed LOS target of 100% of assets in fair or better condition over the next 10 years for linear assets. The City would require an increase in budget from $237k to $400k annually in order to achieve its proposed LOS over this period. The results of the longer-term (25-year) analysis and backlog analysis reveal that less needs are anticipated in the long-term (years 11 to 25), as opposed to the short and medium term (first 10 years).

In addition to these targets, it should also be noted that the nature of the City's storm sewer replacement program is that it is combined with other related corridor assets, such as associated road, sanitary sewer and water assets. Executing work as part of a bundled corridor project provides the City with a way to take advantage of cost efficiencies, minimize disruption to the community, and better schedule/execute its work.

For vertical assets, the City will require a budget of $11k annually to meet targets in the short and medium-term (10 years), and a budget of $52k annually to meet its targets over the long-term.

It is recommended that the City proceed with the budgets detailed in Scenario 3 (Meet 100% LOS in 10-years), which is an investment of $411k annually ($400k for linear, and $11k for vertical). This will ensure that the City meets its service level targets in both the medium and long-term. It will also address the backlog in the forecast period.

The City has also completed an analysis of needs over a 50-year time period. This analysis indicated that the recommended funding under Scenario 3 should be sufficient to address the 50-year asset needs.

Note that over time, storm sewer replacement will become a major part of the City's budget, as the proportion of combined sewers further decreases in favour of dedicated storm sewers. As a result, the portion of the City's budget currently committed to combined sewer separation will transfer to stormwater to address these anticipated increased needs.

4.5. WATER DISTRIBUTION NETWORK

The City of Cornwall is responsible for distributing water to residents and businesses through the water distribution network. Water is distributed for the purposes of consumption/use and fire protection. The water distribution network includes all assets from the Water Purification Plant where water intake and treatment occur, to the distribution of water through transmission mains, distribution mains, and elevated storage tanks.

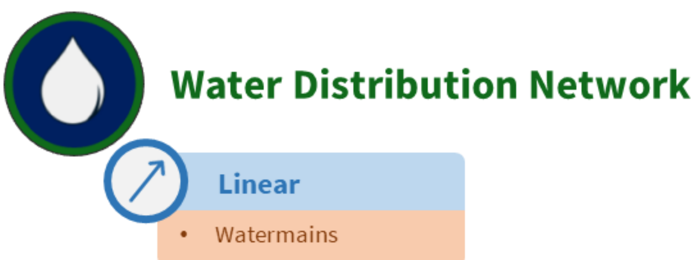

Figure 4-40: Asset Classes of the Water Distribution Network

This section documents the current state of water distribution assets, the LOS provided to citizens, the lifecycle activities performed on the assets, and the financial strategy required to deliver water distribution services. Note that this AMP only covers the asset classes detailed above. The watermains asset class includes pipes, hydrants, valves, and other appurtenances. The City's Water Purification Plant, Reservoirs and Elevated Storage Tanks are not included within the scope of this AMP.

4.5.1 State of Infrastructure

Asset Inventory and Valuation

The replacement cost for the water distribution network is approximately $345.9 million and is summarized in Figure 4-41 and Table 4-29.

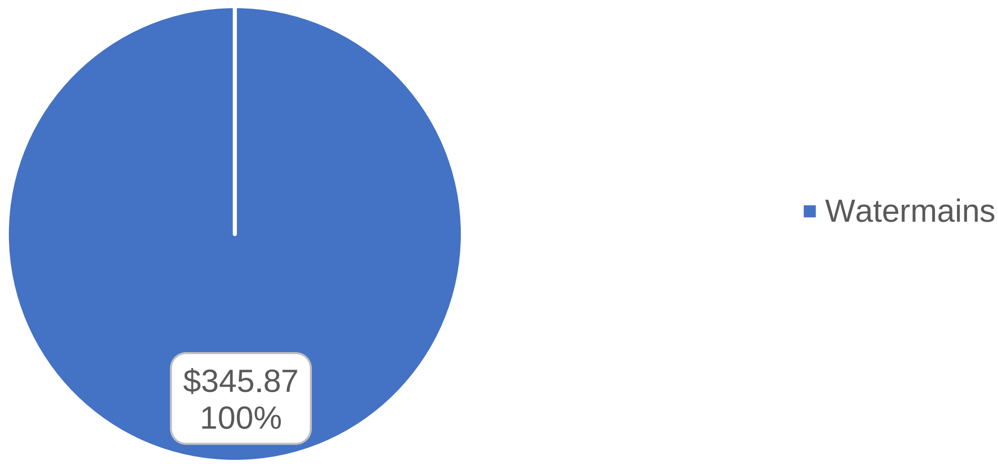

Figure 4-41: Water Distribution Network Valuation ($M)

Table 4-29: Water Distribution Network Asset Quantities

Category	Asset Category	Asset Class	Quantity	Replacement Cost
Water Distribution Network	Linear	Watermains	271.47 km	$345.87M

Age Summary

The average age of assets compared to the average estimated service lives for the water distribution network is provided in Figure 4-42. Presenting the asset portfolio in this manner provides a high-level understanding of the average age of assets relative to their lifecycles, which in turn can give an idea of overall condition based on age. For Watermains, a comparison of average age to the average estimated service lives is also provided at a more granular level (by material type) in Figure 4-43. This figure illustrates watermains that are made up of the material type “Cast Iron 1” have surpassed its average estimated service lives by 11 years. The City has strategically attempted to reline cast iron watermains over the years, which will extend their service life and avoid more costly replacement activities. This explains why many watermains are close to their service life, and watermains that are of type “Cast Iron 1” are past their service life. Although watermains are allowed to age in this scenario, their condition is improved through relining, allowing their service life to be extended.

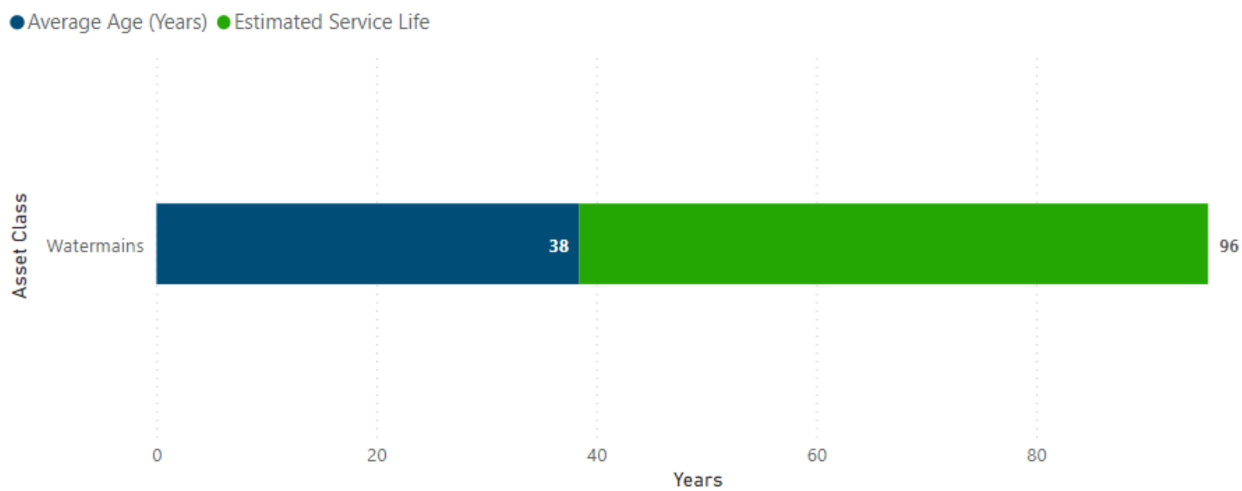

Figure 4-42: Water Distribution Network Average Age as a Proportion of Average ESL

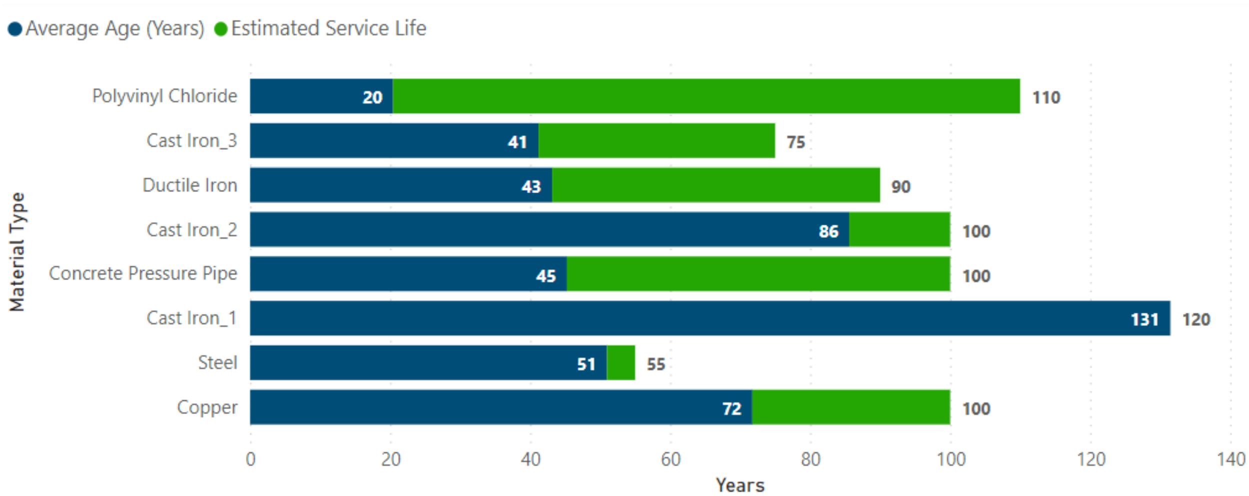

Figure 4-43: Watermains Average Age as a Proportion of Average ESL by Material

The following figure illustrates the average age compared to the average estimated service life of only the relined pipes. Relined pipes are labelled as material type Cured-in-Place Pipe (CIPP). The City estimates that relining adds an additional 50 years to a pipe's ESL.

Approximately 2.5% of the City's total watermain network (by replacement value) is relined. This includes approximately 6.1% of Cast Iron_1 watermains, 11.3% of Cast Iron_2 watermains, 30.0% of Cast Iron_3 watermains, and 1.4% of Ductile Iron watermains.

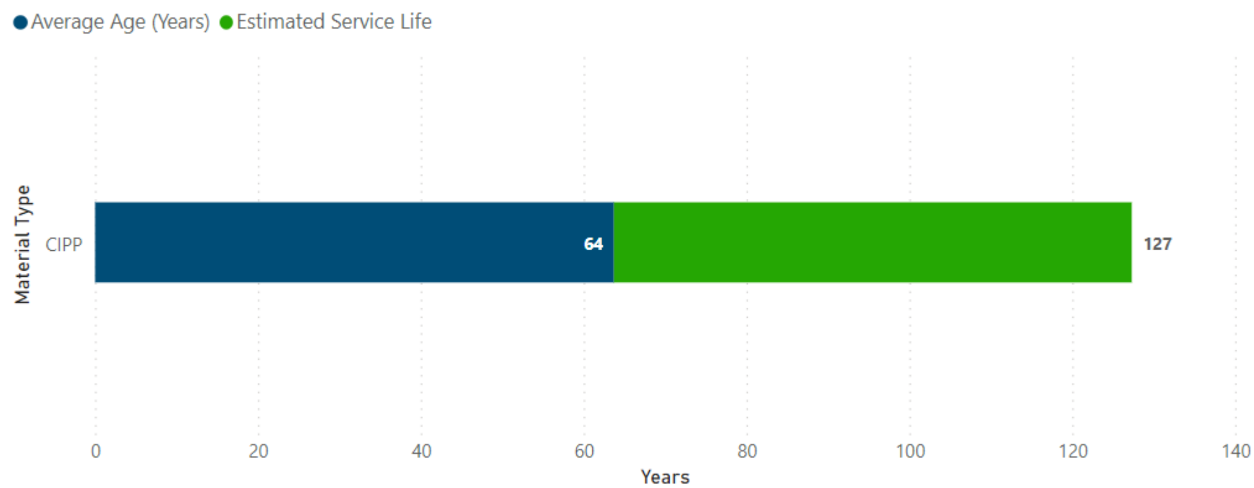

Figure 4-44: Lined Watermains Average Age as a Proportion of Average ESL by Material

In the figure above, the average age of watermains is calculated using the original installation date of the pipe before it was relined. The average ESL is calculated using the extended life that the pipe is anticipated to experience due to relining, which is the pipe's original ESL plus an additional 50 years.

The pipes within the water distribution network consist of various material types, each with a unique service life value attributed to it. Note that there are three (3) types of cast iron watermains, labelled 1, 2 and 3. Cast Iron_1 watermains represent the oldest installed cast iron pipes, which have the thickest walls of the three types. Cast Iron_2 watermains were installed during the depression era and have thinner walls. Cast Iron_3 watermains were installed during and post World War II, have the thinnest walls, and typically experience more problems as a result. The City attempts to strategically reline cast iron watermains wherever feasible and possible. The material type, service life and remaining lifespan of each watermain material type is summarized in Table 4-30.

Table 4-30: Watermain Service Life

Material	Length (km)	Percentage of Network (%)	Service Life (Years)	Average Age (Years)	Remaining Service Life (Years)
Polyvinyl Chloride	98.30	36.21%	110	22	88
Cast Iron_3	73.94	27.24%	75	42	33
Ductile Iron	48.82	17.98%	110	44	66
Cast Iron_2	24.97	9.20%	100	86	14
Concrete Pressure Pipe	19.82	7.30%	100	51	49
Cast Iron_1	2.83	1.04%	120	133	0
Steel	2.14	0.79%	75	51	24
Copper	0.65	0.24%	100	73	27

The distribution of assets by construction date is provided in Figure 4-45. It illustrates that the largest historical investment in the water distribution network was made between 1970 and 1974. The 1970's increase in construction activity in occurred due to a need to accommodate growth. This resulted in an increase of the construction of larger diameter watermains, as well as a general overall increase in watermains of other sizes. The increase in construction activity for this time period can also be seen in other asset classes, such as Sanitary Sewers. Due to the increases in the 1970's, the City can expect to see an increased need in replacement in the future (beyond the scope of analysis for this AMP), as these pipes near the end of their service lives and require replacement.

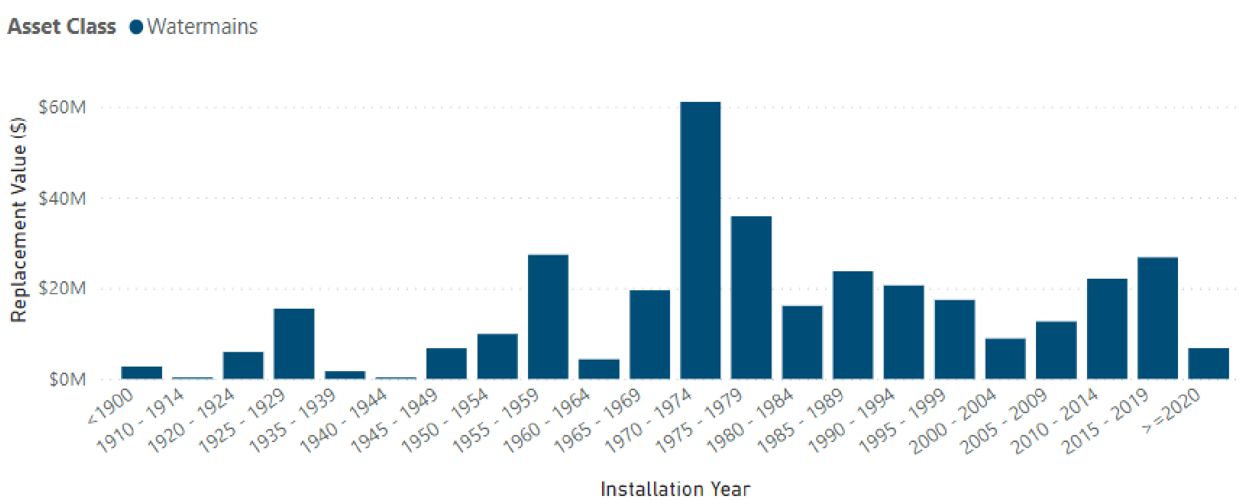

Figure 4-45: Water Distribution Network Construction Date Distribution

Asset Condition

The City assesses the condition of watermains using a watermain performance index (WPI) rating. The WPI ranges from 0 to 100 and is calculated based on the remaining life of a watermain, the number of breaks, average length, and whether or not the watermain meets fire flow requirements. Table 4-31 presents the logic used to convert WPI scores and life consumed values into a condition category. The condition distribution by replacement value is provided in Figure 4-46 and Figure 4-47.

Table 4-31: Watermain Condition Ratings

Category	Life Consumed	Condition Ratings Watermains (WPI Score)
Very Good	0% to 25%	80 – 100
Good	25% to 50%	50 – 80
Fair	50% to 75%	20 – 50
Poor	75% to 100%	10 – 20
Very Poor	>100%	0 – 10

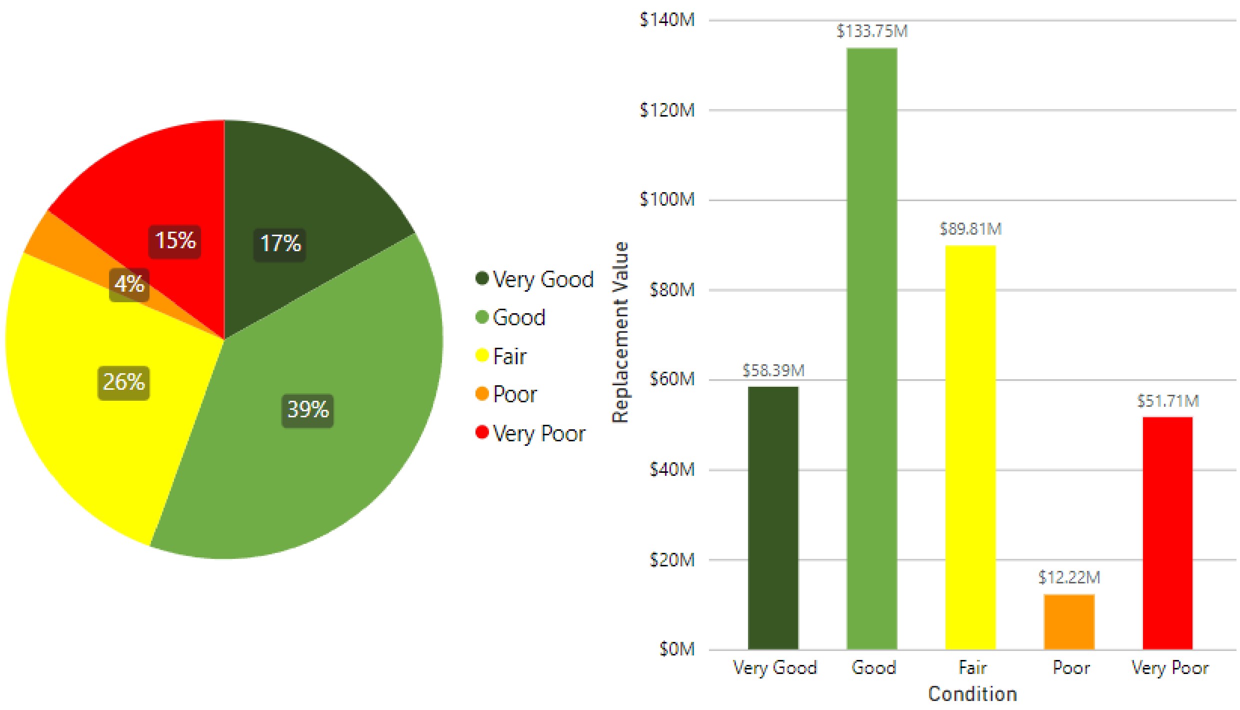

Figure 4-46: Water Distribution Network Overall Condition

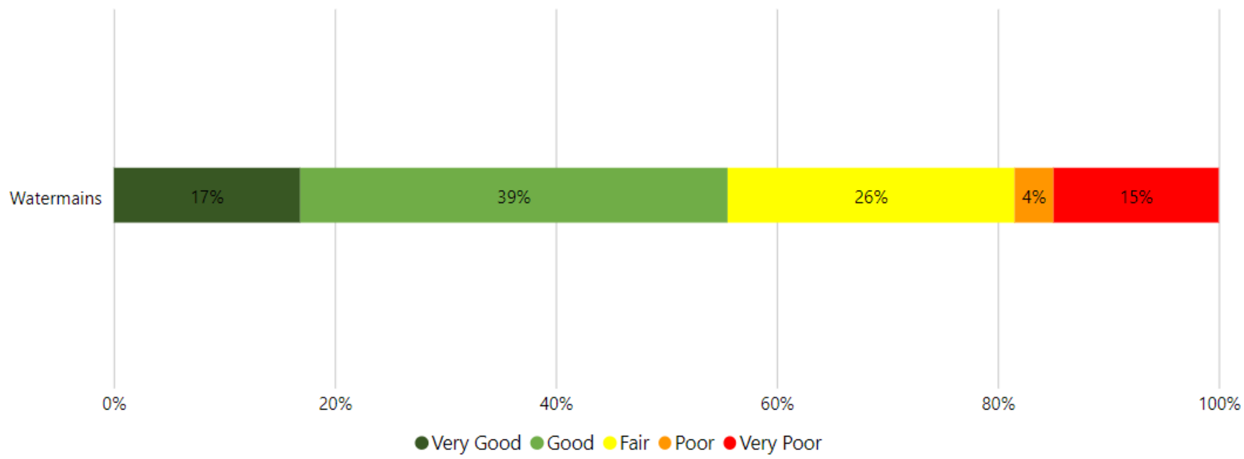

Figure 4-47: Water Distribution Network Condition Distribution by Replacement Value

The following figure provides a breakdown of watermain condition distributions by material type. Note that certain material types such as Cast Iron_1, Cast Iron_2 and Steel are mostly in Very Poor condition. Since these material types do not make up a large proportion of the network, they do not have a large contribution to the overall condition of the watermain network, as illustrated in Figure 4-47 above.

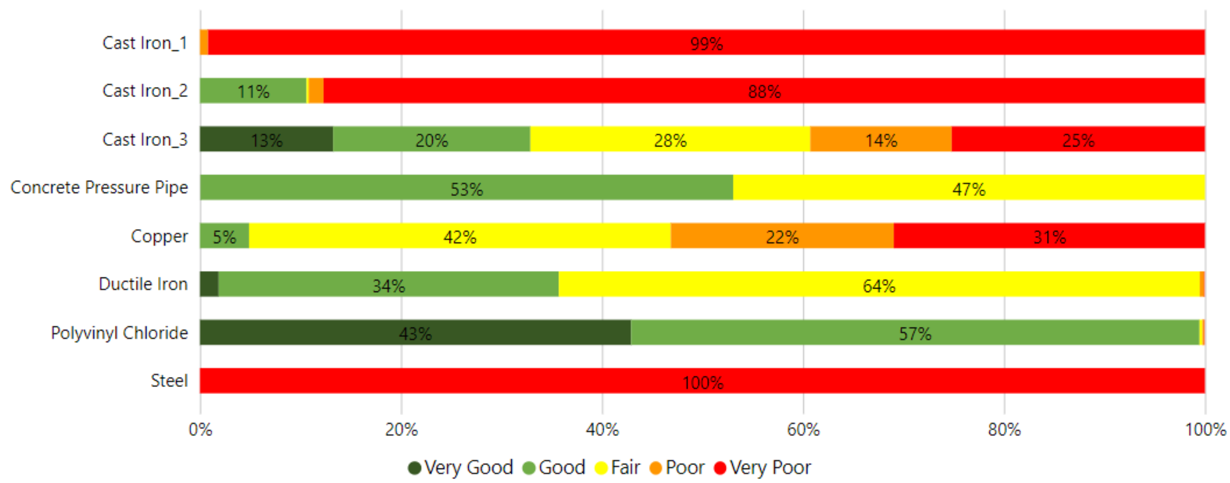

Figure 4-48: Water Distribution Network (Material Type) Condition Distribution by Replacement Value

Table 4-32: Watermain Breaks Over the Last 10 Years

Year	Number of Breaks	Number of Breaks/100KM
2012	58	21
2013	47	17
2014	53	20
2015	86	32
2016	40	15
2017	34	13
2018	65	24
2019	56	21
2020	39	14
2021	42	15

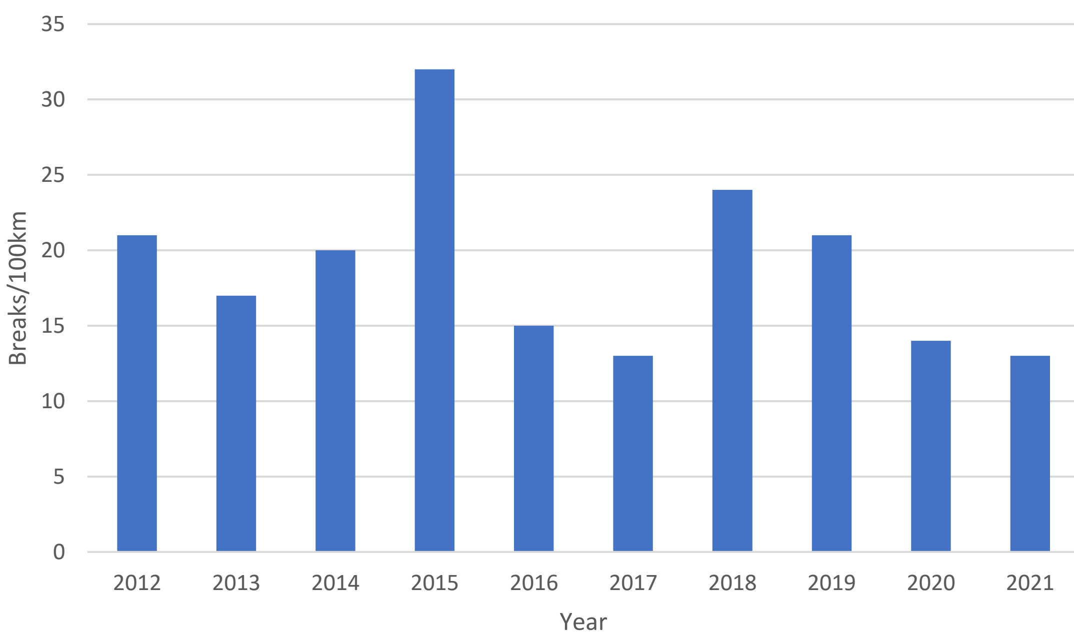

Figure 4-49: Watermain Breaks per 100km

The City's average break rate over this 10-year period was 19 breaks/100km; however, the data above illustrates an improvement of the City's break rate. The most current (2021) break rate value was reduced to 15 breaks/100km over this time period. This illustrates the work the City has undertook towards meeting performance objectives. Note that the provincial average of watermain breaks was 9.2/100-km[3], which is still lower than the City's rate. The average cost for the City to repair a watermain break is $13,890; however the cost is closer to $7,000 for standard 150mm watermains. These costs include labour, tools, restoration, contracted services, etc.

Data Sources and Confidence

The data sources to support this state of the infrastructure analysis, as well as the other AM planning analyses required to complete this AMP is provided in Table 4-33.

Table 4-33: Water Distribution Network - Condition Data Collection

Asset Class	Condition Data Collection Technique	Frequency
Watermains	▪ Watermain break records recorded and logged in the City's watermain break database. ▪ WPI score updated.	▪ Ongoing

The data completeness and confidence values for the aforementioned data is provided in Table 4-34.

Table 4-34: Water Distribution Network - Data Confidence

Asset Class	Completeness	Confidence	Comments
Watermains	**Good**	**High**	No data gaps.

4.5.2 Levels of Service

The City's goal is to provide a reliable, high quality, and safe water distribution network to all its residents and businesses. This is achieved by minimizing service disruptions, ensuring the water is safe for consumption by complying with water quality regulations, and being able to protect the communities with adequate fire flow. The community and technical LOS for the water distribution network are shown in Table 4-35 and Table 4-36.

The measures are categorized in two types: Mandatory LOS measures as per O. Reg. 588/17, and foundational measures selected by the City.

(orange)	Represents a mandatory LOS measure as per O. Reg. 588/17
(grey)	Represents a Foundational Metric selected by the City

[3] Ontario Sewer and Watermain Construction Association. "The State of Ontario's Water and Wastewater Infrastructure" (2018).

Table 4-35: Water Distribution Network Community Levels of Service

Subservice	Community Measures	Service Attributes	Current Performance
Water Distribution Network	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system.	Scope	Almost 98% of properties within urban areas are connected to the municipal water system.
	Description, which may include maps, of the user groups or areas of the municipality that have fire flow.	Scope	Almost 91% of properties within urban areas are connected to the municipal water system for fire flow.
	Description of boil water advisories and service interruptions.	Reliable	No boil water advisories, few service interruptions due to City responsibilities
	Water is available when needed	Reliable	The technical LOS measures relating to reliability indicate that the system is generally reliable but still has some room for improvement. The percentage of assets are in poor or worse condition is 18%, which could result in more breaks and an interruption of service. On the other hand, the City's breaks per 100km have been reducing over time, which indicates that service levels have been improving.
	Water had adequate pressure	Reliable, Quality	The City's reliability metrics are not fully met, which could have an associated impact on water pressure.
	Water is safe to drink	Safe	The City is meeting its technical safety objectives with respect to water quality.
	Water is of high quality (taste, smell and colour)	Quality, Safe	The City's Quality and Safety Technical metrics indicate that the City's water is of high quality. The City is meeting 100% of its water quality objectives and has received no complaints with

Subservice	Community Measures	Service Attributes	Current Performance
			respect to quality in the most recent recorded year.
	Water is available for fire services	Safe, Reliable	Almost 90% of the community has adequate fire flow protection. Also, it should be noted that approximately 1/3 of the City's watermains are in poor or worse condition, which may affect reliability, and in turn could affect availability of water for fire services.

Table 4-36: Water Distribution Network Technical Levels of Service

Service Attribute	Performance Measure	Current Performance
Scope	Percentage of properties connected to the municipal water system.	98%
	Percentage of community with sufficient fire flow[4] protection (i.e. established by the City's water model to have adequate pressure to meet fire flow requirements)	91%
Reliable	The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system.	0
	The number of connection-days per year due to watermain breaks compared to the total number of properties connected to the municipal water system.	0.02
	Percentage of watermains in fair or better condition	82%
	Annual number of breaks per 100km (Table 4-32)	13
	Number of service interruptions per year	36
Safe	Percentage of assets in compliance with all applicable water quality regulations	100%
	Percentage of community with sufficient fire flow protection	91%
Quality	Annual number of complaints due to low pressure or discoloured water	0

[4] Sufficient fire flow is defined as having adequate pressure for firefighting needs as per the water model

4.5.3 Lifecycle Management Strategy

Lifecycle Activities

For the City to provide water distribution services and work towards target LOS of fair or better condition, certain lifecycle activities are performed on the water distribution assets. These include non-infrastructure solutions such as developing various plans and incentives; maintenance activities to repair assets; relining watermains; pipe and appurtenance replacement; asset and material disposal; and expanding and upgrading assets to support growth. Table 4-37 summarizes the lifecycle activities performed on watermains.

Table 4-37: Watermains Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, capacity studies, AMPs)	As required
	Water model	As required, based on needs
	Water usage reduction incentives	Ongoing
Operations and Maintenance	Break repairs (clamping)	As required
	Service and chamber repairs	As required
	Exercise valves	Annually
	Valve replacements	As required
	Hydrant flushing	Annually
	Hydrant repairs	As required
Rehabilitation	Lining	When asset reaches poor condition, where feasible
Replacement	Full pipe replacement	When asset reaches poor condition, when relining not undertaken
	Valves, services and chamber replacement	As needed, or coordinated with watermain replacement
Disposal	Removed as part of the project or abandoned	Coordinated with watermain replacement
Expansion/Service Changes	Pipe upsizing	Based on growth, modelling and studies

4.5.4 Funding the Lifecycle Activities

The City uses the lifecycle strategies described in Section 4.5.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Water assets was defined as the percentage of assets that were in fair or better condition.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments, $4.9M annually, resulted in the performance forecast illustrated in Figure 4-50 .The percentage of assets in fair or better condition increases from 82% to 90% over the 10-year forecast period.

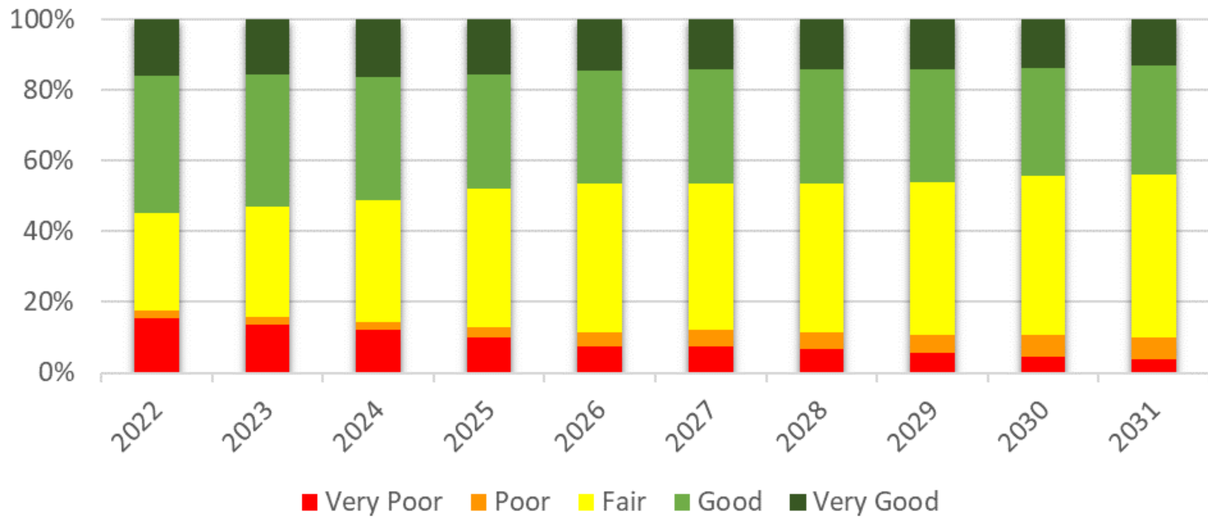

Figure 4-50: Water Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $2.3M annually over a 10-year period and resulted in the performance forecast illustrated in Figure 4-51. The percentage of assets in fair or better condition remains around 82% in this scenario.

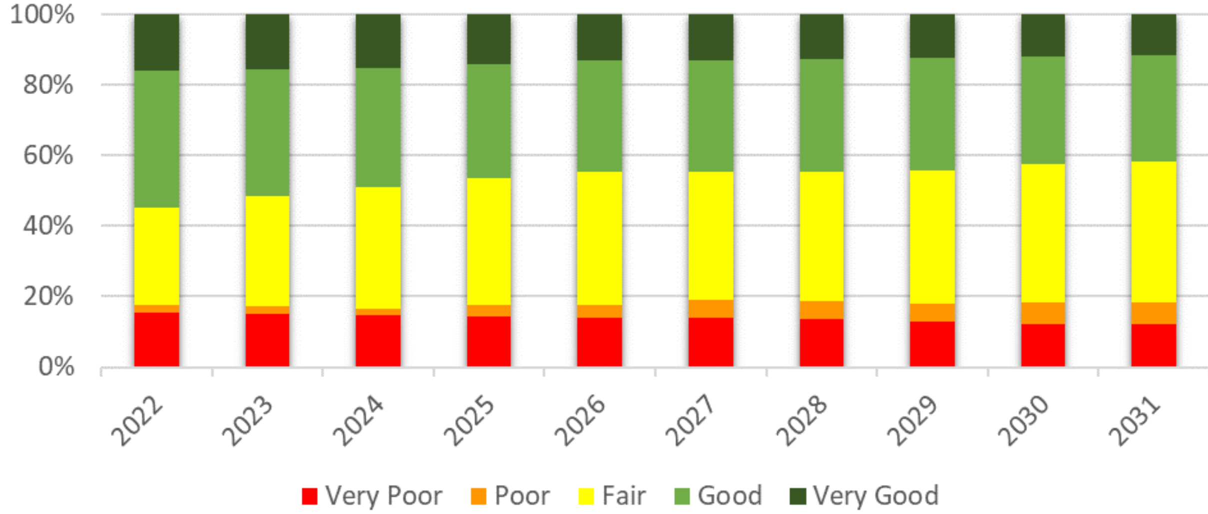

Figure 4-51: Water Performance Forecast with Cost to Maintain LOS

Scenario 3: Achieve LOS in 10 Years

The City has set the proposed LOS to be 100% of assets in fair or better condition. The cost to meet this LOS in 10 years was determined to be $8.7M annually and resulted in the performance forecast illustrated in Figure 4-52.

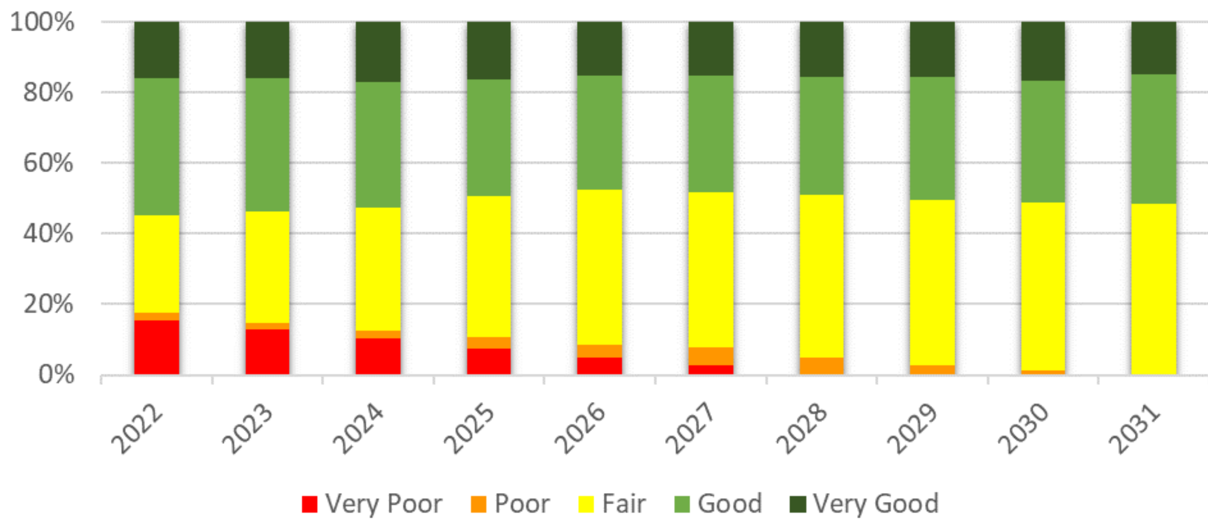

Figure 4-52: Water Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to achieve the City's proposed LOS in 25 years was determined to be $6.1M annually and resulted in the performance forecast illustrated in Figure 4-53. Note that assets in poor condition appear on this graph in the years 2038 and beyond due to additional concentrated needs that arise at this time. Using a consistent average annual spend, these needs are eliminated within a few years after they arise to ensure that the City reaches its targets by the end of the forecast period.

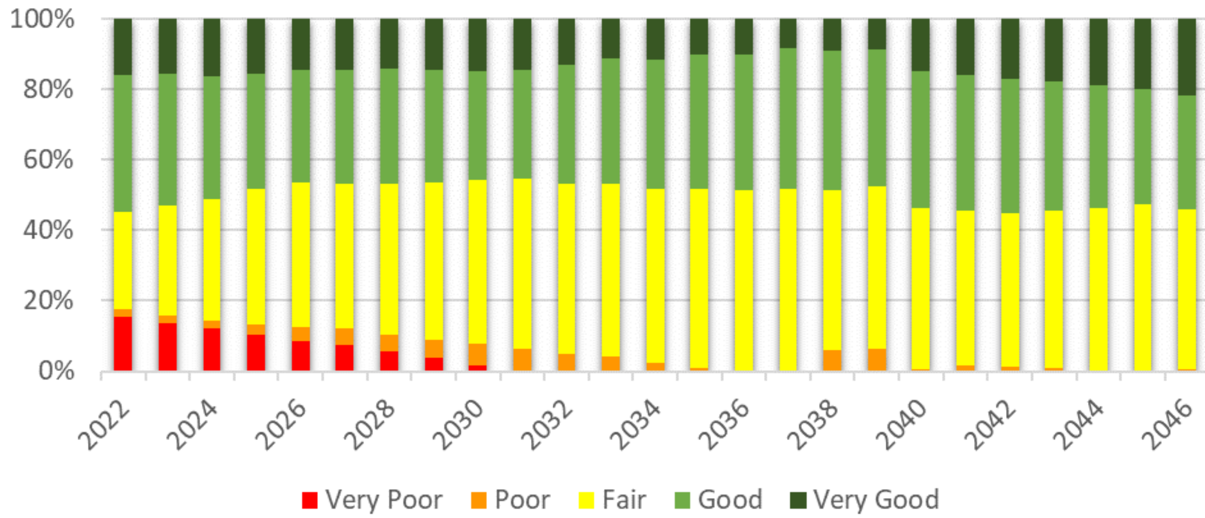

Figure 4-53: Water Performance Forecast with Cost to Achieve LOS in 25 Years

Note that this scenario illustrates a portion of assets in poor condition, occurring in 2038 and 2039. This increase in poor condition assets occurs as a result of the way that the scenario analysis is completed. The analysis uses an average spending amount with the goal of meeting targets at the end of the 25-year period. The average spending amount is representative of a consistent investment of the City, but can result in some assets performing below targets in years where more needs are concentrated or have accumulated.

Scenario 5: Backlog Analysis

The backlog analysis indicated that a $51.6M (52km) backlog is present in Water Distribution assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 4-54.

Note that the weighted average performance decreases over time in this figure. Average performance is calculated as the average condition (performance) rating of all assets, weighted by replacement value. Average performance declines in this scenario due to the fact that the ratio of very good/good assets to fair assets is decreasing. More assets in fair condition will result in the average performance value to decline, even though service levels are improving since as poor and very poor assets are being replaced.

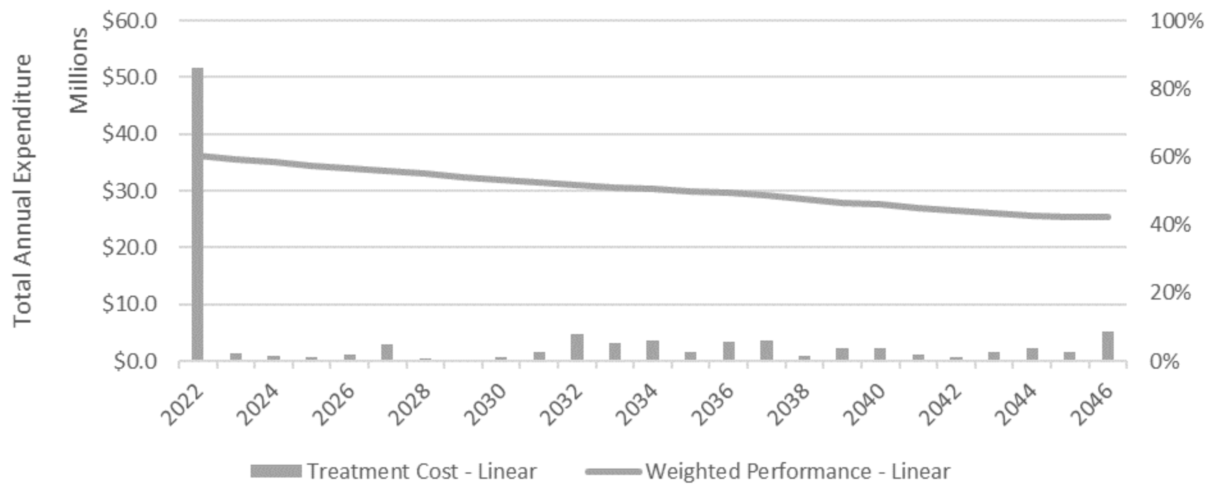

Figure 4-54: Water Backlog Analysis

4.5.5 Recommendations

The results of the various scenario analyses indicated that the City's current planned budget will result in an improvement in service levels over the next 10 years. Nevertheless, to meet its target LOS, the City will require additional investment over both the 10 and 25-year forecast periods. This is illustrated in Figure 4-54 by the significant backlog in the City's watermain replacement needs. To meet proposed LOS over 10 or 25 years, an increase in budget to $8.7M and $6.1M respectively would be required.

In addition to these targets, it should also be noted that the nature of the City's watermain replacement program is that it is combined with other related corridor assets, such as associated road, storm sewer and sanitary sewer assets. Executing work as part of a bundled corridor project provides the City with a way to take advantage of cost efficiencies, minimize disruption to the community, and better schedule/execute its work.

It is recommended that the City proceed with the budget detailed in Scenario 4 (Meet 100% LOS in 25-years), which is an investment of $6.1M annually. This will ensure that service levels are sustained in both the medium and long-term. It will also address the backlog in the forecast period.

The City has also completed an analysis of needs over a 50-year time period. This analysis indicated that current funding will not be sufficient to meet needs over this time period. The recommended funding under Scenario 4 is expected to be sufficient to address the 50-year asset needs.

5. TRANSPORTATION SERVICES

5.1. SUMMARY

The City's Transportation Services service area includes the subservices of Road Network and Active Transportation. These services are responsible for ensuring that the community is able to travel in and around the City. Road Network assets primarily provide vehicular, pedestrian and cycling traffic. Active Transportation assets generally apply to pedestrians and cyclists and include assets that are part of the City's recreational transportation network.

An overall summary of the replacement value and condition of the assets within this service area is provided in Figure 5-1. Subsections 5.2 and 5.3 provide additional details on the asset classes within each subservice.

Although the majority of the Transportation related assets are in Fair to Good condition, expenditures are required for lifecycle strategies to address Poor and Very Poor assets, prevent other assets from reaching Poor condition and maintaining service levels.

	Replacement Value	Condition
Road Network	$535.62M	Fair
Active Transportation	$47.29M	Good
Transportation Total	$582.91M	

Figure 5-1: Transportation Services Overall Condition and Replacement Value Summary

5.2. ROAD NETWORK

The City of Cornwall is responsible for providing transportation services for the various vehicular, pedestrian and cycling traffic throughout the City. The City's road network spans over 275 km, which is supplemented by various peripheral assets, including traffic management assets, and municipal structures such as bridges and culverts. The City is responsible for maintaining these road network assets.

Figure 5-2: Asset Classes of the Road Network

This section documents the current state of road network assets, the LOS provided to citizens, the lifecycle activities performed on the assets, and the financial strategy required to deliver road network services. The roadway asset class includes asphalt, road base, traffic islands, curbs, line painting, bicycle lanes.

5.2.1 State of Infrastructure

Asset Inventory and Valuation

The replacement cost for the road network is approximately $535.6 million and is summarized in Figure 5-3 and Table 5-1.

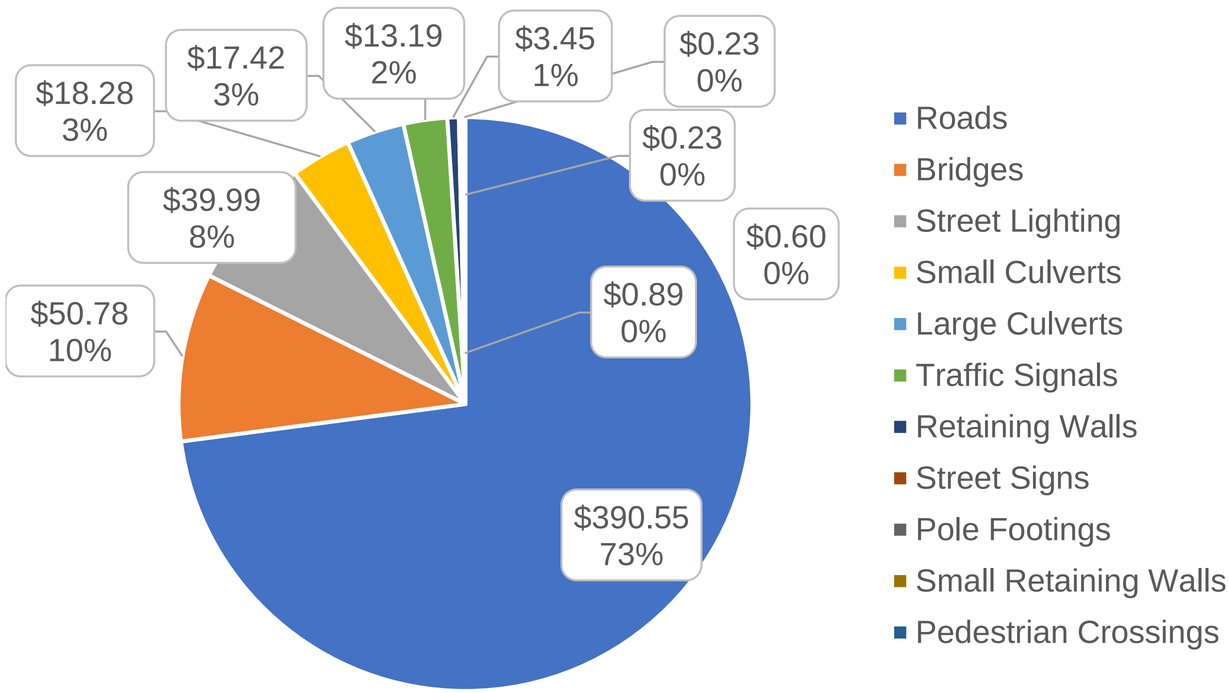

Figure 5-3: Road Network Valuation ($M)

Table 5-1: Road Network Asset Quantities

Category	Asset Category	Asset Class	Quantity	Replacement Cost
Road Network	Roadway	Roads	275.26 km	$390.55M
		Small Culverts	302 Structures	$18.28M
		Small Retaining Walls	17 Structures	$0.23M
	Traffic Management	Traffic Signals	68 Units	$13.19M
		Street Lighting	5,447 Units	$39.99M
		Street Signs	10,358 Units	$0.89M
		Pedestrian Crossings	3 Units	$0.23M
	Municipal Structures	Bridges	12 Structures	$50.78M
		Large Culverts	13 Structures	$17.42M
		Pole Footings	2 Structures	$0.60M
		Retaining Walls	9 Structures	$3.45M

Age Summary

The average age of assets compared to the average estimated service lives for the road network is provided in Figure 5-4. Presenting the asset portfolio in this manner provides a high-level understanding of the average age of assets relative to their lifecycles, which in turn can give an idea of overall condition based on age. For roads, a comparison of average age to the average estimated service lives is also provided by road class in Figure 5-5.

The road class hierarchy is defined below:

- **Arterial road**: Provide the major corridors for traffic movement (increased speed and volumes) and serve to channel traffic to other areas.
- **Collector road**: Serve to collect and distribute traffic between the local roads and arterial roads.
- **Local road**: Serve primarily to provide access to properties.

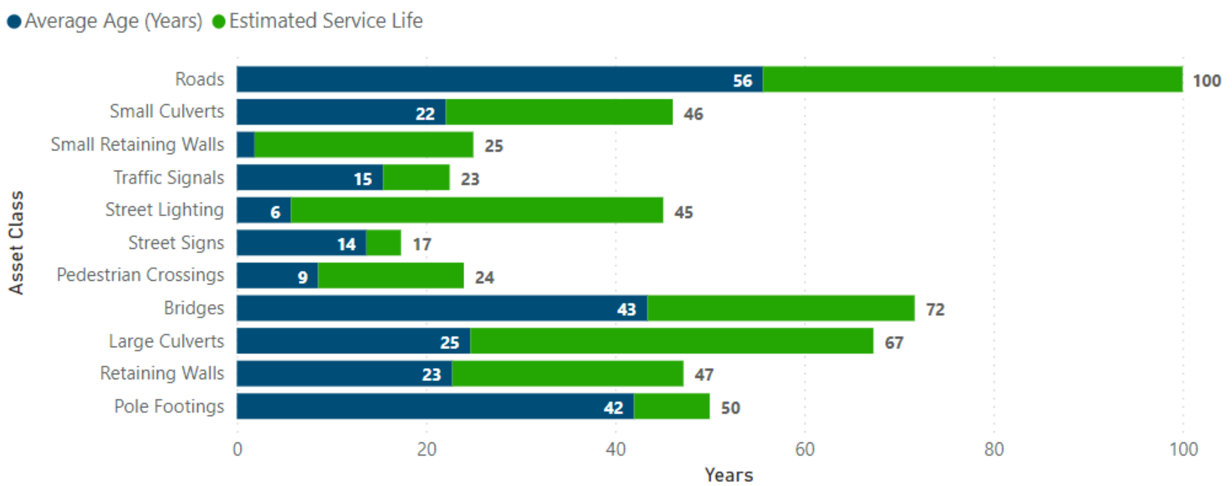

Figure 5-4: Road Network Average Age as a Proportion of Average ESL

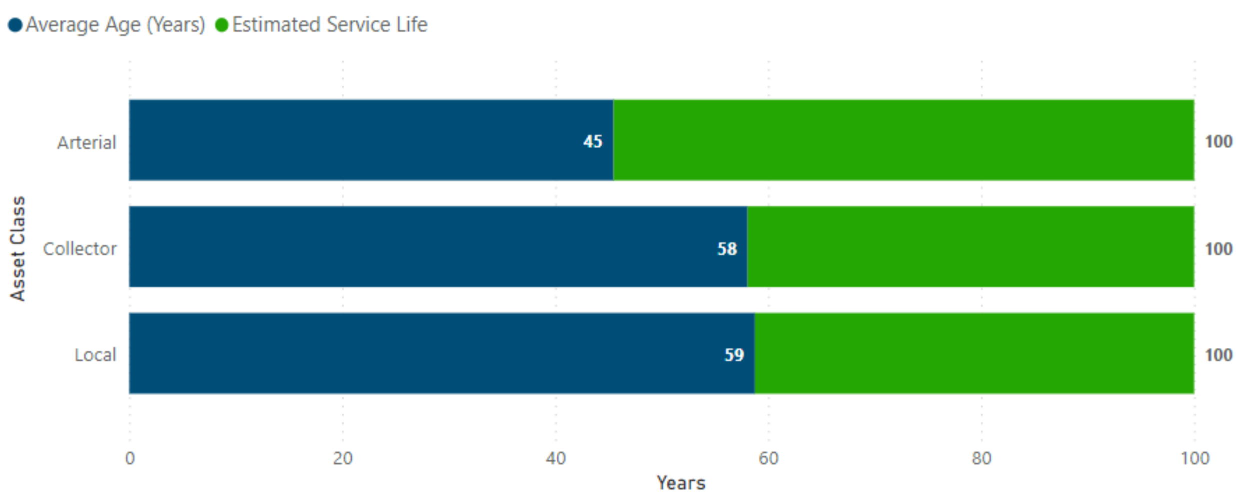

Figure 5-5: Roads Average Age as a Proportion of Average ESL by Road Class

The distribution of assets by construction date is provided in Figure 5-6. It illustrates that large investments in roads assets occurred in the late 1940s and through the 1950s. This increase in construction activity in occurred due to a need to accommodate growth. Due to the increases in the 1940s and 1950s the City has been experiencing an increased need in road replacement, as these assets have been nearing the end of their service lives and require replacement.

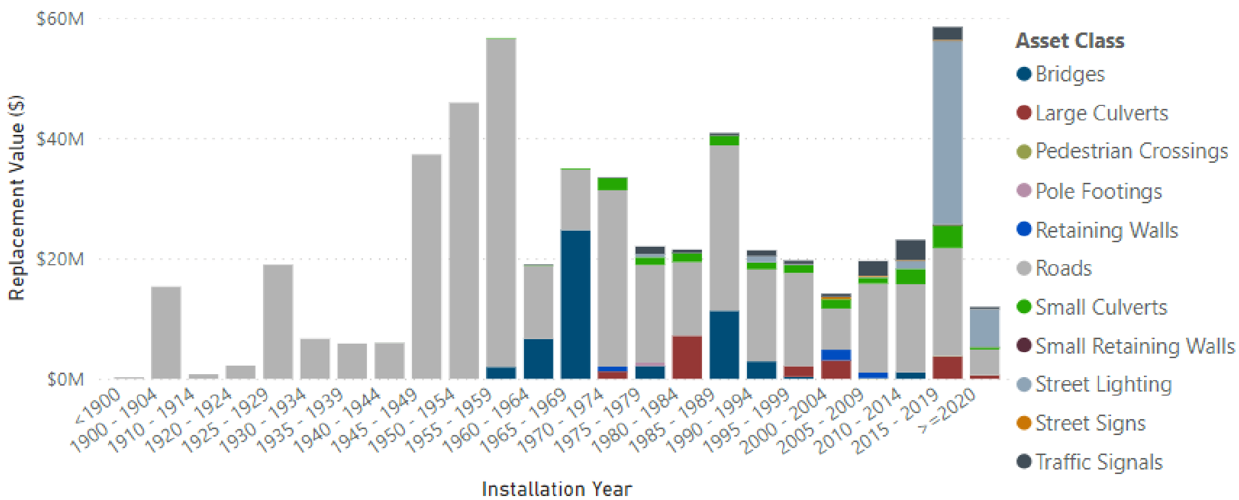

Figure 5-6: Road Network Construction Date Distribution

Asset Condition

The City has been assessing the condition of roads using Pavement Condition Ratings (PCR) and performing Ontario Structure Inspection Manual (OSIM) inspections to assess the condition of municipal structures. New roads have a PCR of 100, which decreases as the condition of the roads degrade. After road resurfacing, PCR is increased. The City can continue to resurface roads to improve overall road condition until such point where a full depth replacement is required.

The condition of municipal structures is measured by a 100-point rating scale called the Bridge Condition Index (BCI). The BCI is a measurement of the replacement value of various condition states of a structure's components, relative to the overall replacement value of the structure.

Traffic assets are assessed using life consumed. Table 5-2 to Table 5-4 present the logic used to convert PCR grades, BCI and life consumed into a condition category. The condition distribution by replacement value is provided in Figure 5-7 and Figure 5-8, with roads further broken down by road class in Figure 5-9.

Table 5-2: Roads Condition Ratings

Category	Life Consumed	Condition Ratings		
		Arterial Roads (PCR Ratings)	Collector Roads (PCR Ratings)	Local Roads (PCR Ratings)
Very Good	0% to 25%	81-100	81-100	81-100
Good	25% to 50%	61-80	61-80	61-80
Fair	50% to 75%	51-60	51-60	46-60
Poor	75% to 100%	41-50	41-50	41-45
Very Poor	>100%	0-40	0-40	0-40

Table 5-3: Bridges and Culverts Condition Ratings

Category	Condition Ratings	
	Bridges, Large Culverts (BCI) – Non CSP	Bridges, Large Culverts (BCI) - CSP
Very Good	81-100	81-100
Good	71-80	71-80
Fair	51-70	41-70
Poor	36-50	21-40
Very Poor	0-35	0-20

Table 5-4: Other Road Network Asset Condition Ratings

Category	Life Consumed	Condition Ratings
		Small Culverts, Traffic Signals, Street Lighting, Street Signs, Pedestrian Crossings, Retaining Walls, Pole Footings
Very Good	0% to 25%	Life Consumed is the metric used to evaluate condition for these asset classes
Good	25% to 50%	
Fair	50% to 75%	
Poor	75% to 100%	
Very Poor	>100%	

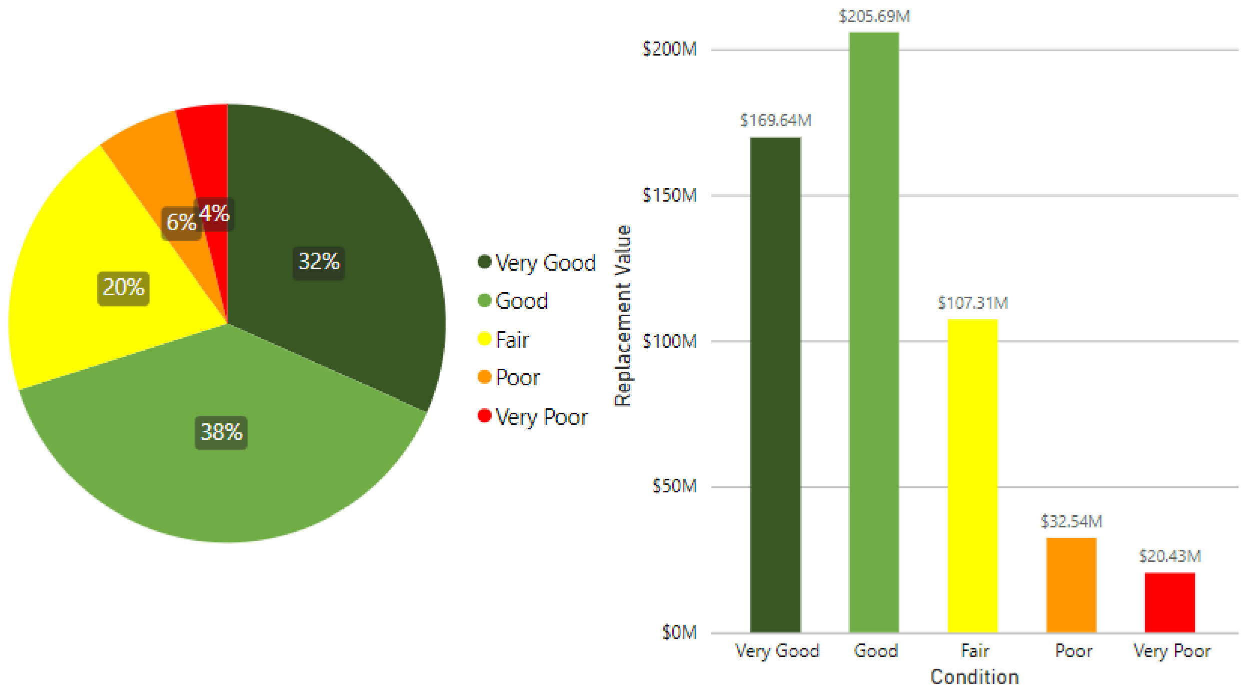

Figure 5-7: Road Network Overall Condition

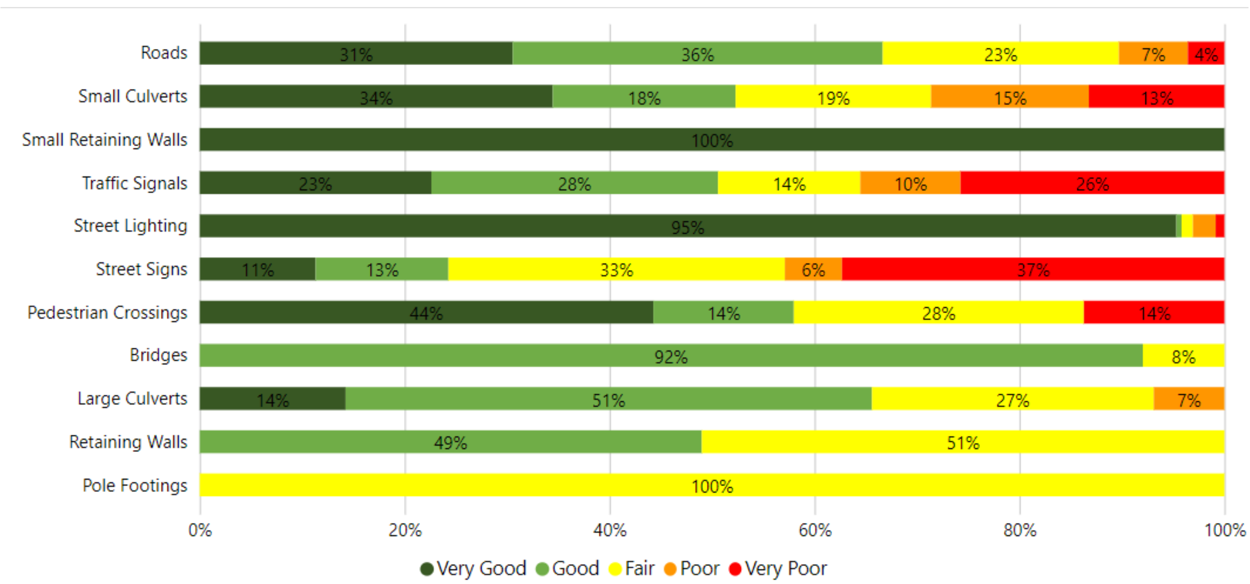

Figure 5-8: Road Network Condition Distribution by Replacement Value

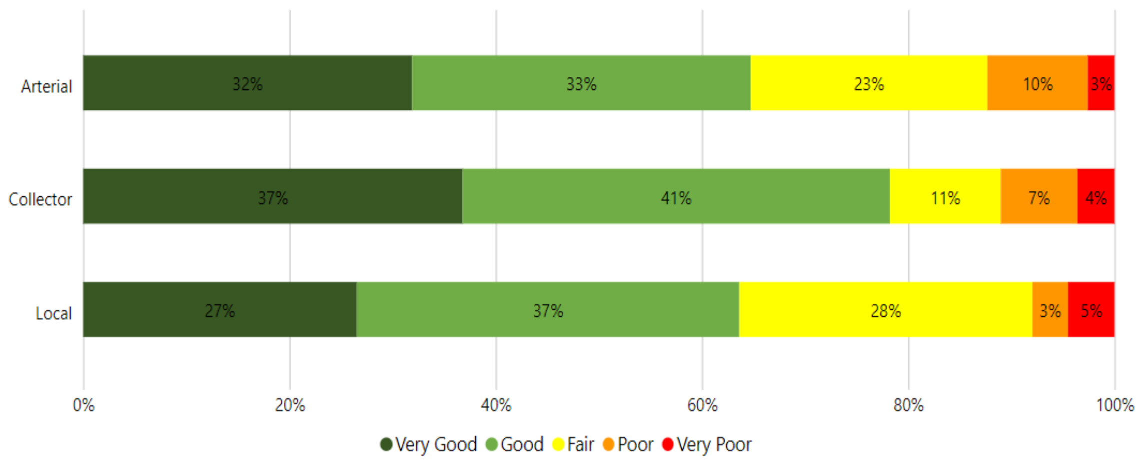

Figure 5-9: Road Class Condition Distribution by Replacement Value

A breakdown of the length of each road-type in various condition states within the municipality is provided in Table 5-5.

Table 5-5: Road Class Condition Distribution by Length

Category	Arterial (km)	Collector (km)	Local (km)	Total (km)
Very Good	24.8	15.6	38.4	**78.8**
Good	29.5	18.9	54.7	**103.1**
Fair	17.7	5.0	41.9	**64.6**
Poor	9.3	3.6	5.1	**18.0**
Very Poor	2.2	1.6	6.9	**10.7**

Data Sources and Confidence

The data sources to support this state of the infrastructure analysis, as well as the other AM planning analyses required to complete this AMP is provided in Table 5-6.

Table 5-6: Road Network - Condition Data Collection

Asset Class	Condition Data Collection Technique	Frequency
Roads	▪ Pavement condition assessments completed	▪ 2 years
Small Culverts	▪ Culvert inspections	▪ Annually
Small Retaining Walls	▪ Visual inspections	▪ Annually
Traffic Signals	▪ Visual inspections	▪ Annually
Street Lighting	▪ Visual inspections	▪ Annually

Asset Class	Condition Data Collection Technique	Frequency
Street Signs	▪ Visual inspections	▪ Annually
Pedestrian Crossings	▪ Visual inspections	▪ Annually
Bridges	▪ OSIM bridge inspections	▪ 2 years
Large Culverts	▪ OSIM culvert inspections	▪ 2 years
Retaining Walls	▪ Included with OSIM inspections	▪ 2 years
Pole Footings	▪ Included with OSIM inspections	▪ 2 years

The data completeness and confidence values for the aforementioned data is provided in Table 5-7.

Table 5-7: Road Network - Data Confidence

Asset Class	Completeness	Confidence	Comments
Roads	**Good**	**High**	All road assets last inspected 2021.
Small Culverts	**Good**	**High**	Over half are missing inspection year and condition data. Approx. 8% of assets missing installation year.
Small Retaining Walls	**Good**	**High**	All retaining walls last inspected in 2021
Traffic Signals	**Fair**	**High**	Consists of a list and GIS locations of traffic signals with ESLs and installation years.
Street Lighting	**Fair**	**High**	No inspection year and condition data.
Street Signs	**Good**	**High**	Very few data gaps. Contain duplicate asset IDs. All assets are inspected annually.
Pedestrian Crossings	**Fair**	**High**	Consists a list and GIS locations of pedestrian crossings with ESLs and installation years.
Bridges	**Good**	**High**	Very few data gaps. Condition (BCI) values available but not digitized.
Large Culverts	**Good**	**High**	Very few data gaps. Condition (BCI) values available but not digitized.
Retaining Walls	**Good**	**High**	Very few data gaps. Condition (BCI) values available but not digitized.
Pole Footings	**Good**	**High**	Very few data gaps. Condition values available but not digitized.

5.2.2 Levels of Service

The City's goal is to provide a fair or better condition road network system to all its residents and businesses. This means ensuring that collisions are minimized, the network is convenient to use, and ensuring all assets remain in a state of good repair by performing regular maintenance.

The community and technical LOS for the road network are shown in Table 5-8 and Table 5-9. The measures are categorized in two types: Mandatory LOS measures as per O. Reg. 588/17, and foundational measures selected by the City.

	Represents a mandatory LOS measure as per O. Reg. 588/17
	Represents a foundational measure selected by the City

Table 5-8: Road Network Community Levels of Service

Subservice	Community Measures	Service Attributes	Current Performance
Road Network	Description, which may include maps, of the road network in the municipality and its level of connectivity.	Scope	The City's road network is made of local (53.4%), collector (16.3%) arterial (30.3%) roads. The City's roads provide a high degree of connectivity through the major urban centre, and to the nearest major provincial highway (HWY-401). Most of the City's urban area is connected through the road network, offering a convenient transportation route through and around the City.
	Description or images that illustrate the different levels of road class pavement condition.	Quality	Greater than two thirds of the City's roads are in good or very condition. Approximately 25% of the City's roads are in fair condition. Only approximately 11% of the City's roads are in poor or very poor condition.
	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	Scope	Municipal bridges support a range of traffic, including all types of vehicles including passenger vehicles, transport trucks/vehicles and emergency vehicles. Pedestrians and cyclists are also supported on the City's roads and associated active transportation routes.
	Description or images of the condition of bridges and how this	Quality	All of the City's bridges are in fair or good condition, with the vast majority (> 95%) in good condition. This

Subservice	Community Measures	Service Attributes	Current Performance
	would affect use of the bridges.		would not adversely affect the use of the City's bridges.
	Description or images of the condition of culverts and how this would affect use of the culverts.	Quality	The majority of the City's large culverts (>90%) are in fair or better condition, with 65% of all large culverts in good and very good condition. Approximately 7% of large culverts are in poor condition and no bridges are in very poor condition. Culverts in poor condition may require rehabilitation or replacement, which could result in closures (and detour routes) or load/lane restrictions.
	Road Network is safe to travel on.	Safe, Reliable	The City's road network generally has a high degree of reliability, particularly with respect to the condition of roads and municipal structures. Traffic management assets are also generally in good condition, and the majority are not past their service life. These assets are performing well, ensuring the road network is safe for travel.
	Road Network is comfortable to travel on.	Quality, Reliable, Operational	The City's road network generally has a high degree of reliability, particularly with respect to the condition of roads and municipal structures. Traffic management assets are also generally in good condition, and the majority are not past their service life. These assets are performing well, ensuring the road network is convenient to travel on. The City has also established future quality and operational technical LOS measures. However, these are not measured at this time.

Table 5-9: Road Network Technical Levels of Service

Service Attribute	Performance Measure	Current Performance
Scope	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.	Arterial: 3.30 Collector: 1.49 Local: 4.68
	Percentage of bridges in the municipality with loading or dimensional restrictions.	0
Reliable	For paved roads in the municipality, the average pavement condition index value.	68.7
	For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor).	N/A
	For bridges in the municipality, the average bridge condition index value.	75.2
	For structural culverts in the municipality, the average bridge condition index value.	70.4
	Percentage of arterial roads in fair or better condition	86%
	Percentage of collector roads in fair or better condition	88%
	Percentage of local roads in fair or better condition	89%
	Percentage of small culverts that are not past their service life	87%
	Percentage of small retaining walls that are not past their service life	100%
	Percentage of traffic signals that are not past their service life	70%
	Percentage of streetlights that are not past their service life	97%
	Percentage of pedestrian crossings that are not past their service life	86%
	Percentage of recommendations from bridge inspections that have been completed	100%
	Percentage of bridges in fair or better condition	100%

Service Attribute	Performance Measure	Current Performance
	% of recommendations from culvert inspections that have been complete	100%
	Percentage of large culverts in fair or better condition	93%
	Percentage of retaining walls in fair or better condition	100%
	Percentage of pole footings in fair or better condition	100%
Environmentally Sustainable	% of streetlights that have LED fixtures	98%

5.2.3 Lifecycle Management Strategy

Lifecycle Activities

For the City to provide a road network at the desired LOS, certain lifecycle activities are performed on the road network. These include non-infrastructure solutions such as developing various plans and traffic studies; maintenance activities such as pothole patching, road inspections, and winter maintenance; rehabilitation; reconstruction and surface treatments; asset and material disposal; and expanding and upgrading assets to support growth. Table 5-10 to Table 5-13 summarize the lifecycle activities performed on roadway assets, traffic management assets, and municipal structures.

Table 5-10: Roads Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, traffic studies, AMPs)	As required
	Pavement Condition Assessment	Biennially
	Traffic reduction measures (varied)	Where feasible/possible
Operations and Maintenance	Road Inspections as per the Minimum Maintenance Standards	As per O. Reg. 239/02 frequency
	Road cleaning (sweeping, winter/fall cleaning, removing obstructions)	Ongoing or as required
	Reactive maintenance or spot repairs	As required
	Pothole patching	As required
	Road cut repairs	As required and in conjunction with asphalt rehabilitation works
	Curb repairs	As required and in conjunction with asphalt rehabilitation works
	Guiderail damage repairs	As required
	Ditching	As required and in conjunction with asphalt rehabilitation works

Lifecycle Activity	Description	Frequency
	Line painting and pavement markings	Annually (semi-annually for arterial roads)
	Winter maintenance (snow removal, de-icing)	As required based on storm events
	Crack Sealing	As required
Rehabilitation	Mill and Overlay	As required, based on findings from pavement condition assessments
Replacement	Full depth reconstruction with local base repairs	As required, based on findings from pavement condition assessments
Disposal	Asphalt re-use	Where feasible/possible
	Roadside ditch-cleanout	As required
	Contaminated and excess material disposal	Coordinated with road repair/replacement
	Roadway decommissioning (land transfer agreements, and specific requirements)	Coordinated with road repair/replacement
Expansion/Service Changes	Widening	As identified through master plans and other studies
	Retrofit to add Cycle Lanes	As identified through master plans and other studies
	Various multi-modal transportation solutions	As identified through master plans and other studies
	Pedestrian infrastructure improvements	As identified through master plans and other studies
	New sections of road	As identified through master plans and other studies
	Right of way service enhancements/reductions	As identified through master plans and other studies
	Cross section adjustments/conversions	As identified through master plans and other studies

Table 5-11: Small Culverts Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, capacity studies, AMPs)	As required
	Stormwater model	As required, based on needs
	Flood risk reduction program	Ongoing
Operations and Maintenance	Culvert inspections	Annually for poor/very poor culverts and bi-annually for others.
Rehabilitation	N/A	N/A
Replacement	Culvert replacement	When culvert reaches end of service life
Disposal	Removed as part of the replacement project	Coordinated with replacement works
	Removal as part of road urbanization	Coordinated with road urbanization works
Expansion/Service Changes	On demand changes as per development	As identified through the Development applications

Table 5-12: Traffic Management Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, traffic studies, AMPs)	As required
Operations and Maintenance	Inspections	Annually
	Reactive repairs and maintenance	As required
	Removing obstructions to or traffic signs and devices	As required
Rehabilitation	N/A	N/A
Replacement	Street Sign replacements	Replace when asset reaches the end of its service life
	Street Lighting: replacement of luminaire and/or poles	Replace when asset reaches the end of its service life
	Street Lighting: replacing burned out light bulbs	As required
	Traffic Signal replacements	Replace when asset reaches the end of its service life
Disposal	Removed as part of the project	Coordinated with asset replacement
Expansion/Service Changes	Pedestrian crossing addition/improvements	As identified through master plans and other studies
	Right of way service enhancements/reductions	As identified through master plans and other studies
	Signals, signs, and crossing additions for addition of Active Transportation infrastructure	As identified through master plans and other studies
	Addition of street lighting to improve service	As identified through master plans and other studies
	Upgrade street lighting to LED	Coordinated with Road Rehabilitation/Reconstruction Projects
	On demand changes as per development	As identified through master plans and other studies

Table 5-13: Municipal Structures Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, traffic studies, AMPs)	As required
	OSIM Inspections	Biennially
Operations and Maintenance	Expansion joint and bearing seat cleaning	Annually
	Guide rail maintenance	As required
	Winter maintenance	As required, following storm events
	Concrete sealing and cleaning	As required
	Vegetation and debris/sediment removal	As required
	Guiderail repairs	As required
	Reactive repairs (vehicle impact damage, vandalism, graffiti)	As required
Rehabilitation	Minor and major rehabilitations (varies)	As per OSIM inspection recommendations
Replacement	Bridge/large culvert replacement	As per OSIM inspection recommendations
Disposal	Disposal of asset components	Coordinated with rehabilitation or replacement works.
Expansion/Service Changes	Addition of new structures	As identified through master plans and studies
	Access to subdivision	As identified through master plans and studies
	Addition of sidewalks and active transportation infrastructure	As identified through master plans and studies

5.2.4 Funding the Lifecycle Activities – Roads and Small Retaining Walls

The City uses the lifecycle strategies described in Section 5.2.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Roads and Small transportation assets were defined as the percentage of assets that were fair or better condition.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments, $5.5M annually, resulted in the performance forecast illustrated in Figure 5-10. Under this scenario, the percentage of assets in fair or better condition generally remains at around 88% over the 10-year forecast period.

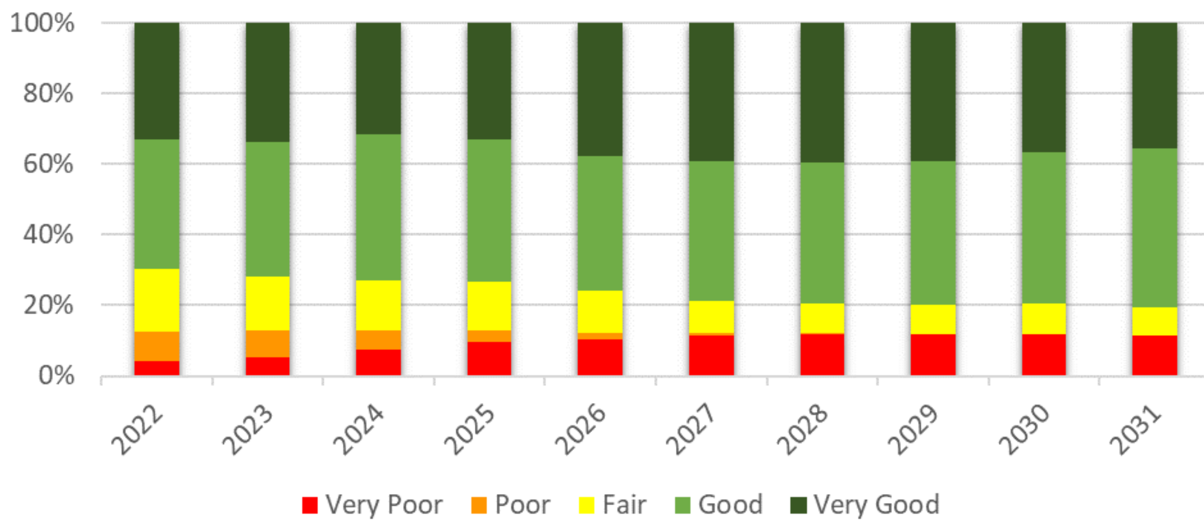

Figure 5-10: Roads and Small Retaining Wall Performance Forecast with Anticipated Budget

Under the anticipated budget, it is noted from the analysis illustrated in Figure 5-10 that the City's LOS does not change; however, the amount of assets in Very Poor condition is expected to increase, as "Poor" assets age and become "Very Poor".

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $5.5M annually over a 10-year period. Note that this cost is the same as the City's anticipated budget, therefore Figure 5-10 (above) illustrates the performance forecast for this scenario.

Scenario 3: Achieve LOS in 10 Years

The City has set the proposed LOS to be 100% of assets in fair or better condition. The cost to meet this LOS in 10 years was determined to be $9.6M annually and resulted in the performance forecast illustrated in Figure 5-11.

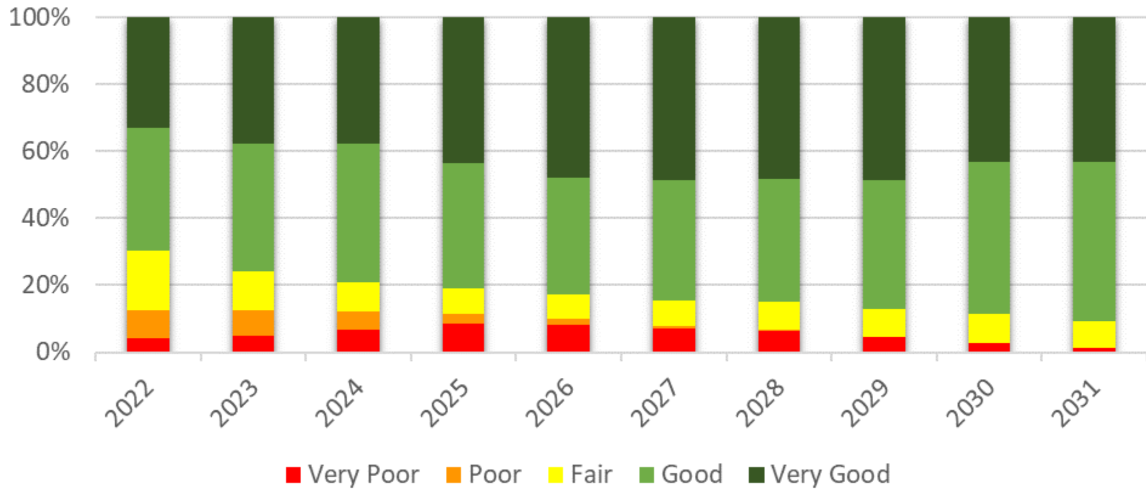

Figure 5-11: Roads and Small Retaining Wall Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to meet the City's target LOS in 25 years was determined to be $6.0M annually and resulted in the performance forecast illustrated in Figure 5-12. Under this scenario, backlog is eliminated within 10-years. Investments in years 11 to 25 are required to maintain these service levels by addressing additional needs that occur in that time period.

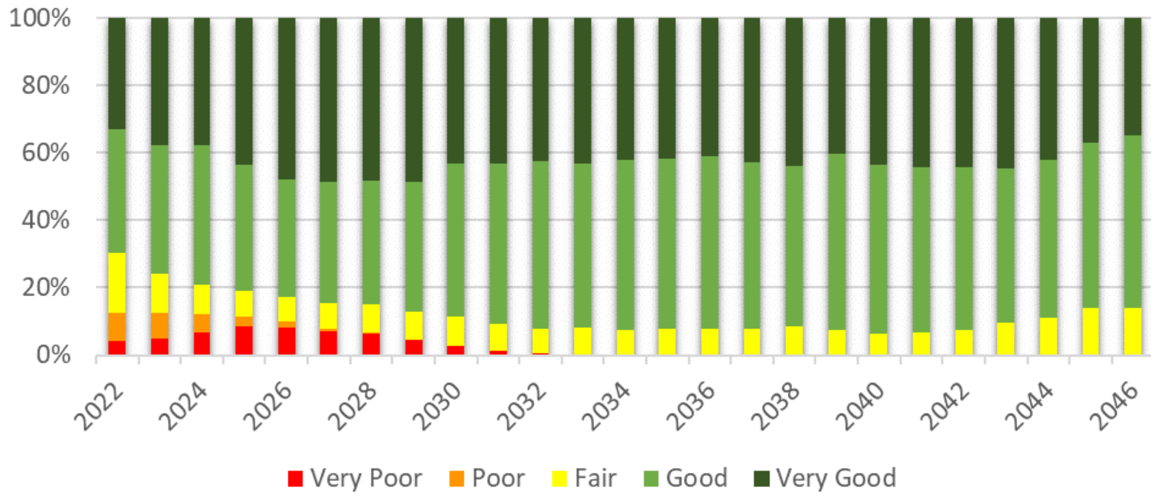

Figure 5-12: Roads and Small Retaining Wall Performance Forecast with Cost to Achieve LOS in 25 Years

Scenario 5: Backlog Analysis

The backlog analysis indicated that a $68.7M (80.9km of roads) backlog is present in Road Network assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 5-13.

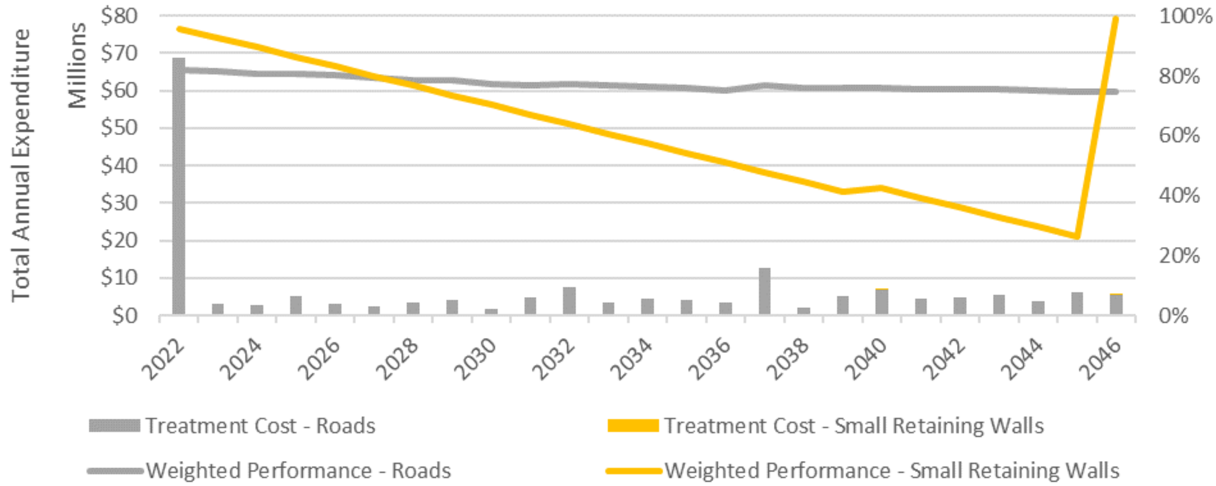

Figure 5-13: Roads and Small Retaining Wall Backlog Analysis

Note that the average performance for small retaining walls increases sharply near the end of the forecast period. This is due to a large quantity of retaining walls that were installed at the same time, which the analysis identifies for replacement at the same time. Replacing these assets will result in a large quantity of new retaining wall assets, which will make the average performance higher. Note that the cost to replace these assets is very small when compared to the roads costs, which is why the costs are not easily visible in the aggregated backlog graph. The retaining walls will be replaced with coordinated projects.

5.2.5 Funding the Lifecycle Activities – Small Culverts

The City uses the lifecycle strategies described in Section 5.2.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Small Culvert assets was defined as the percentage of assets that are not past their estimated service life (i.e., not in very poor condition).

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments, $100K annually, resulted in the performance forecast illustrated in Figure 5-14. The percentage of assets not past their service life decreases in this scenario from 87% to 77% over the 10-year forecast period.

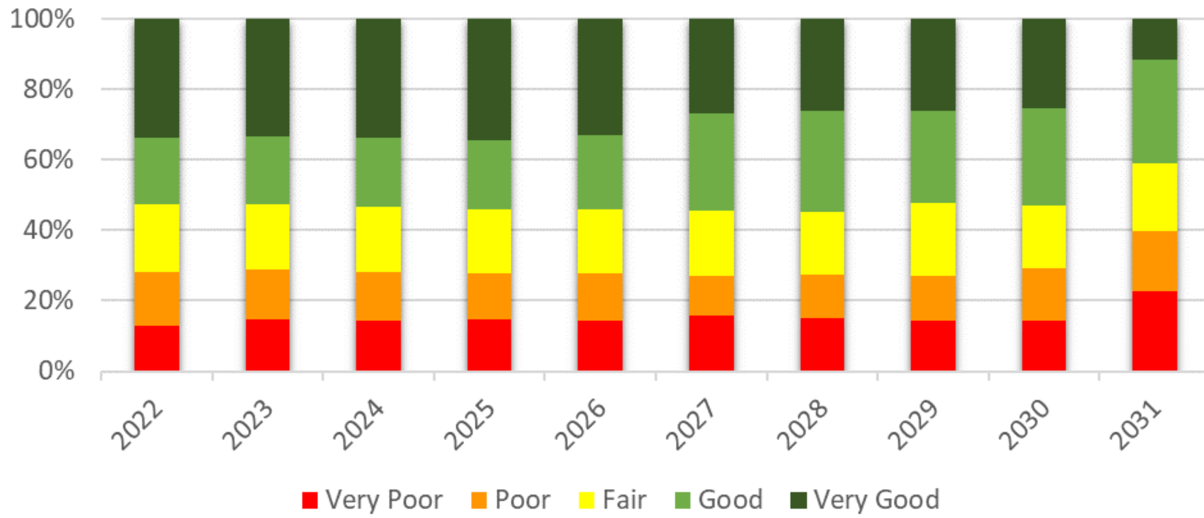

Figure 5-14: Small Culvert Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $273K annually over a 10-year period and resulted in the performance forecast illustrated in Figure 5-15. The percentage of assets that have not passed their estimated service life remains around 87% in this scenario.

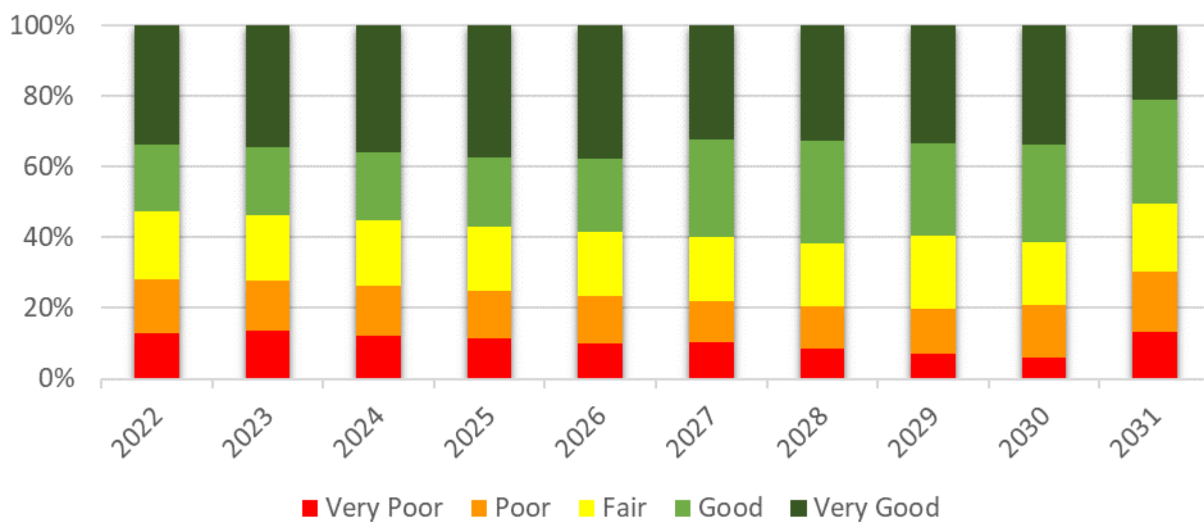

Figure 5-15: Small Culvert Performance Forecast with Cost to Maintain LOS

Scenario 3: Achieve LOS in 10 Years

The City has set its proposed LOS to be 100% of assets that have not exceeded their service life. The cost to meet this LOS in 10 years was determined to be $514K annually and resulted in the performance forecast illustrated in Figure 5-16.

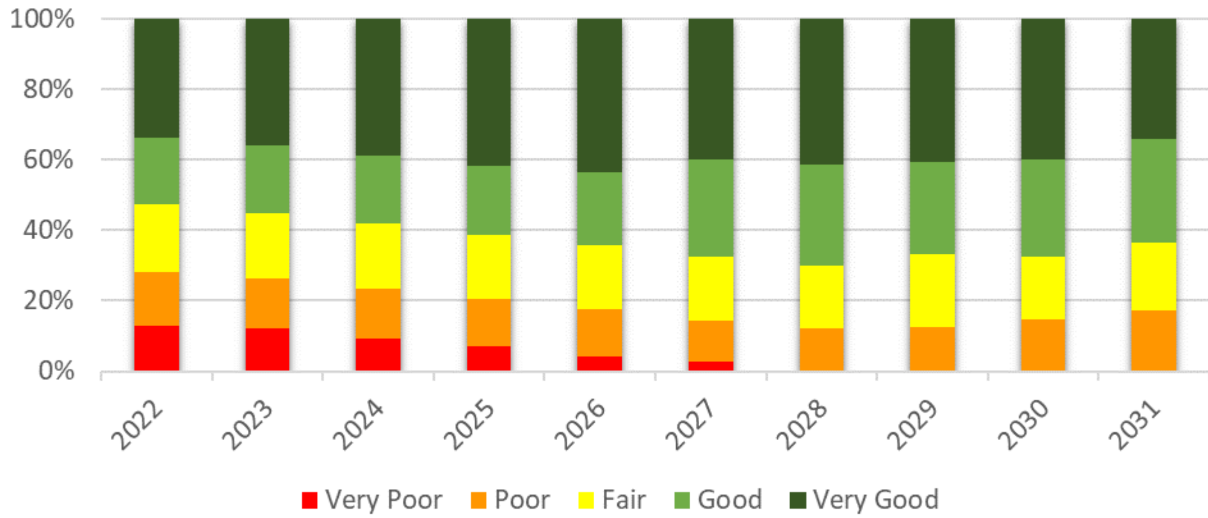

Figure 5-16: Small Culvert Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to meet the City's target LOS in 25 years was determined to be $330K annually and resulted in the performance forecast illustrated in Figure 5-17.

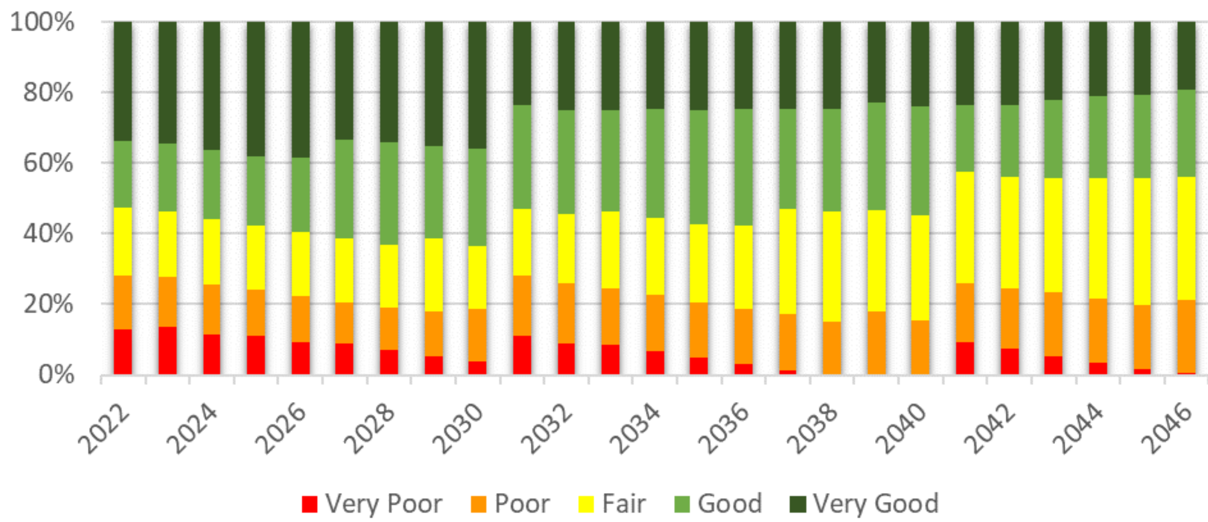

Figure 5-17: Small Culvert Performance Forecast with Cost to Achieve LOS in 25 Years

Note that fluctuations in the assets in very poor condition occur due to a concentration of needs that arises in certain years of the forecast period. This concentration is visualized in the backlog analysis below.

Scenario 5: Backlog Analysis

The backlog analysis indicated that a $2.4M backlog is present in Small Culvert assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 5-18.

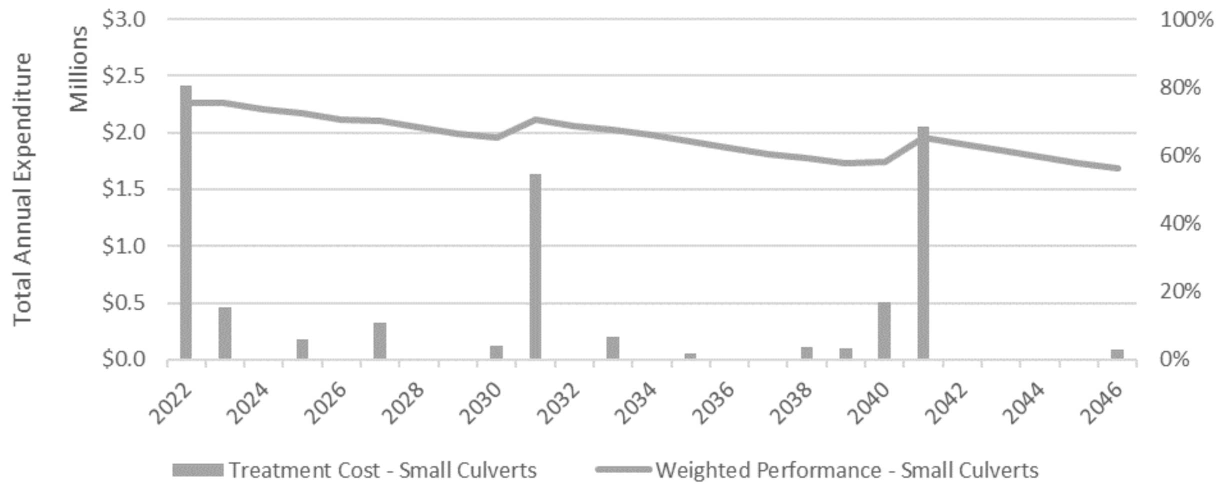

Figure 5-18: Small Culvert Backlog Analysis

5.2.6 Funding the Lifecycle Activities – Traffic Signals and Pedestrian Crossings

The City uses the lifecycle strategies described in Section 5.2.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Traffic Signals and Pedestrian Crossings assets was defined as the percentage of assets that have not exceeded their service life.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments, $410K annually, resulted in the performance forecast illustrated in Figure 5-19.The percentage of assets that have not passed their service life increases from 70% to 83% over the 10-year forecast period.

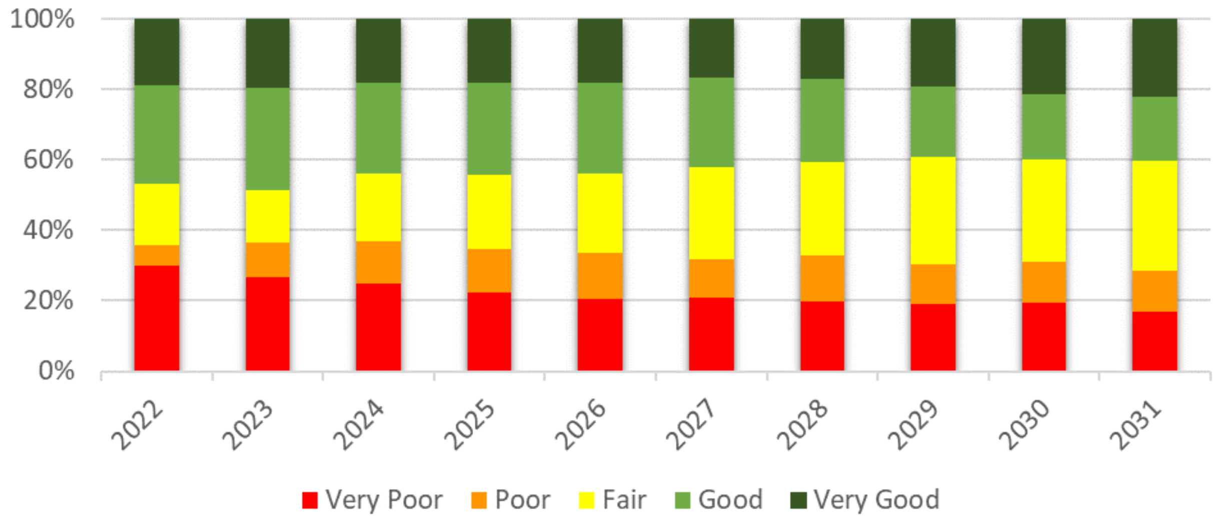

Figure 5-19: Traffic Signals and Pedestrian Crossings Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $215K annually over a 10-year period and resulted in the performance forecast illustrated in Figure 5-20. The percentage of assets that have not exceeded their service life remains around 70%.

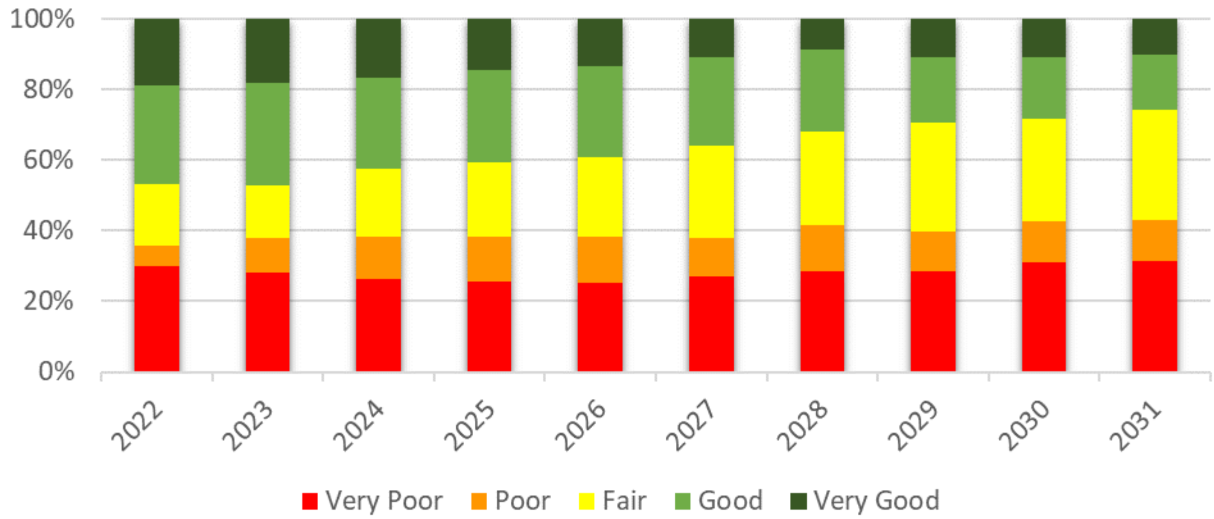

Figure 5-20: Traffic Signals and Pedestrian Crossings Performance Forecast with Cost to Maintain LOS

Scenario 3: Achieve LOS in 10 Years

The City has set the proposed LOS to be 100% of assets that have not exceeded their service life. The cost to meet this LOS in 10 years was determined to be $635K annually and resulted in the performance forecast illustrated in Figure 5-21.

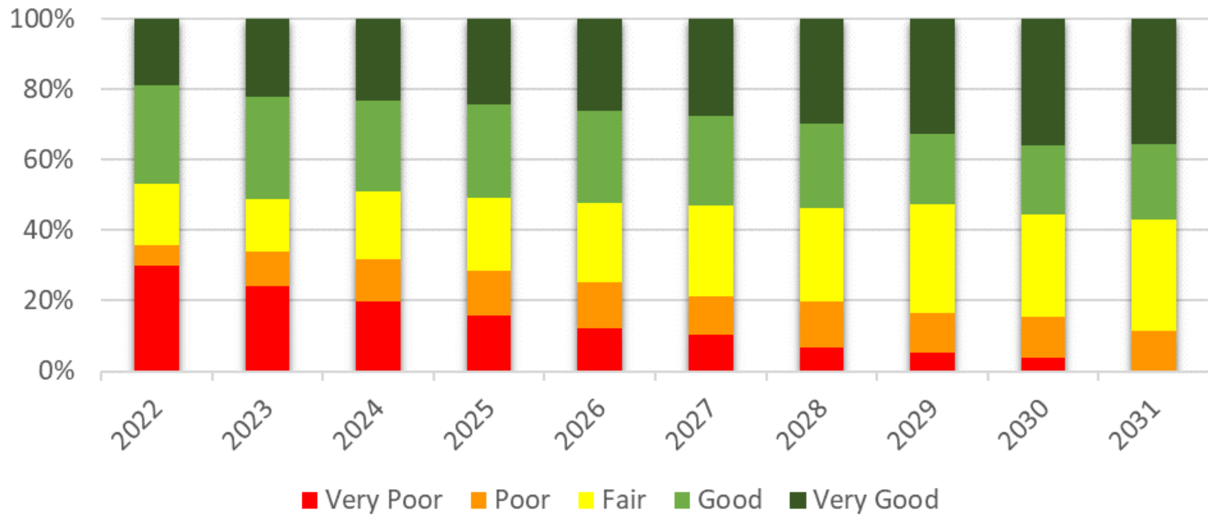

Figure 5-21: Traffic Signals and Pedestrian Crossings Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to meet the LOS in 25 years was determined to be $546K annually and resulted in the performance forecast illustrated in Figure 5-22.

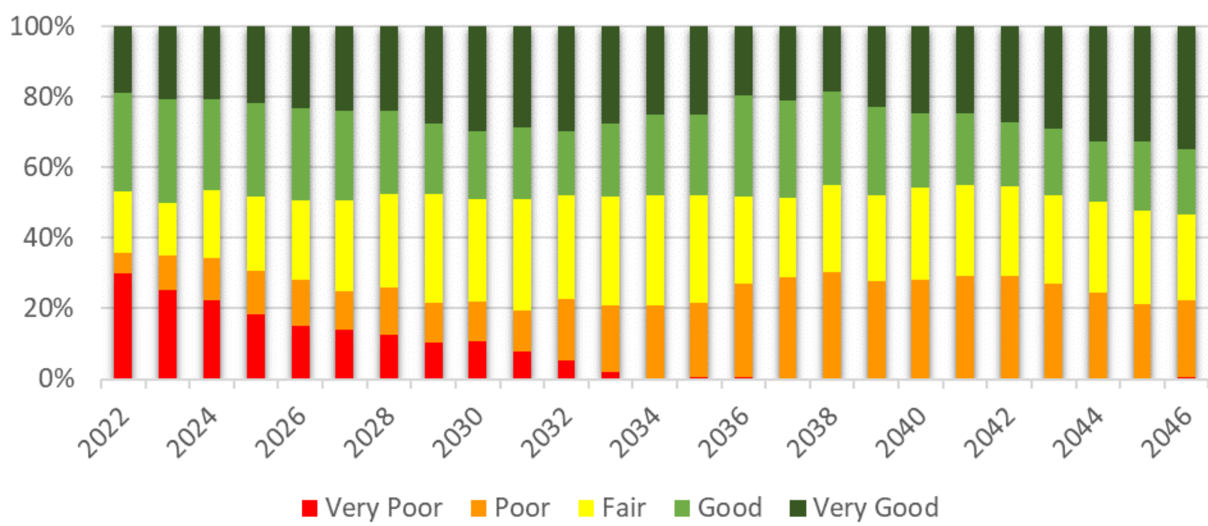

Figure 5-22: Traffic Signals and Pedestrian Crossings Performance Forecast with Cost to Achieve LOS in 25 Years

Scenario 5: Backlog Analysis

The backlog analysis indicated that a $4.2M backlog is present in Traffic Signals and Pedestrian Crossing assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 5-23.

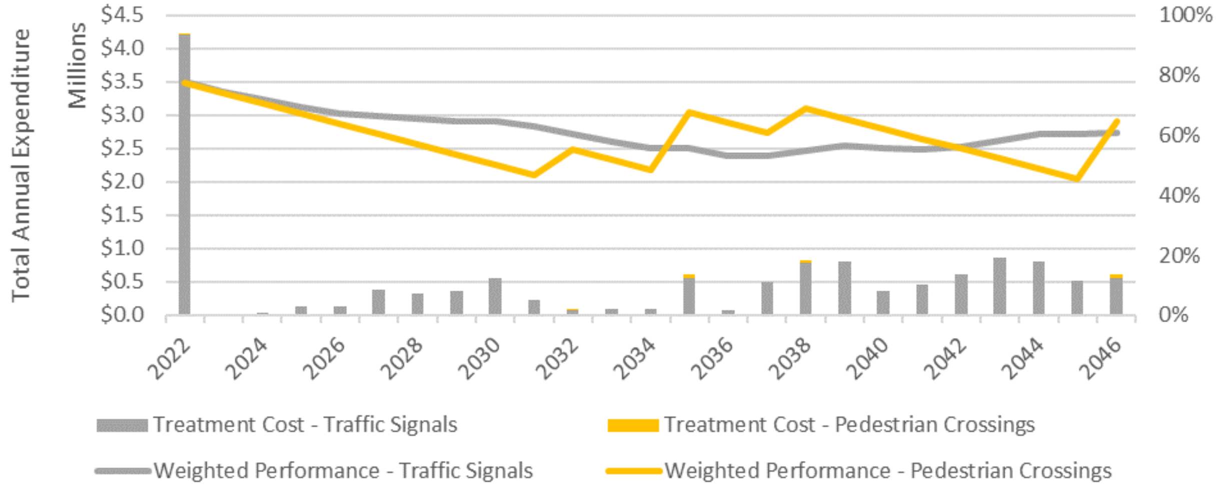

Figure 5-23: Traffic Signals and Pedestrian Crossings Backlog Analysis

5.2.7 Funding the Lifecycle Activities – Street Lighting

The City uses the lifecycle strategies described in Section 5.2.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Street Lighting assets was defined as the percentage of assets not in very poor condition.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments, $175K annually, resulted in the performance forecast illustrated in Figure 5-24.The percentage of assets that have not exceeded their service life remains at 100% over the 10-year forecast period.

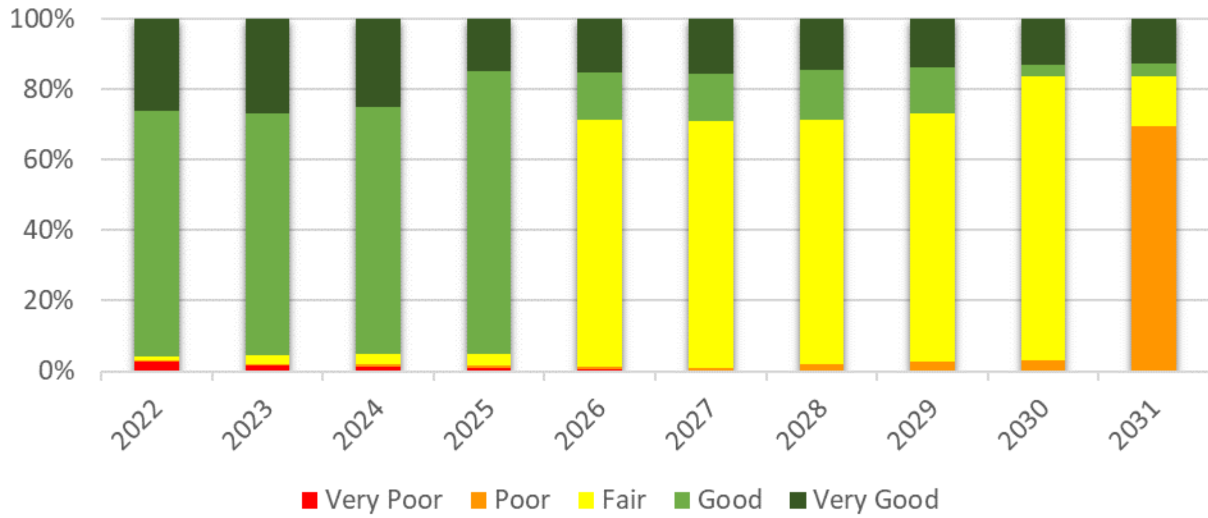

Figure 5-24: Street Lighting Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $49K annually over a 10-year period and resulted in the performance forecast illustrated in Figure 5-25. The percentage of assets that have not exceeded their service life remains at around 99% in this scenario.

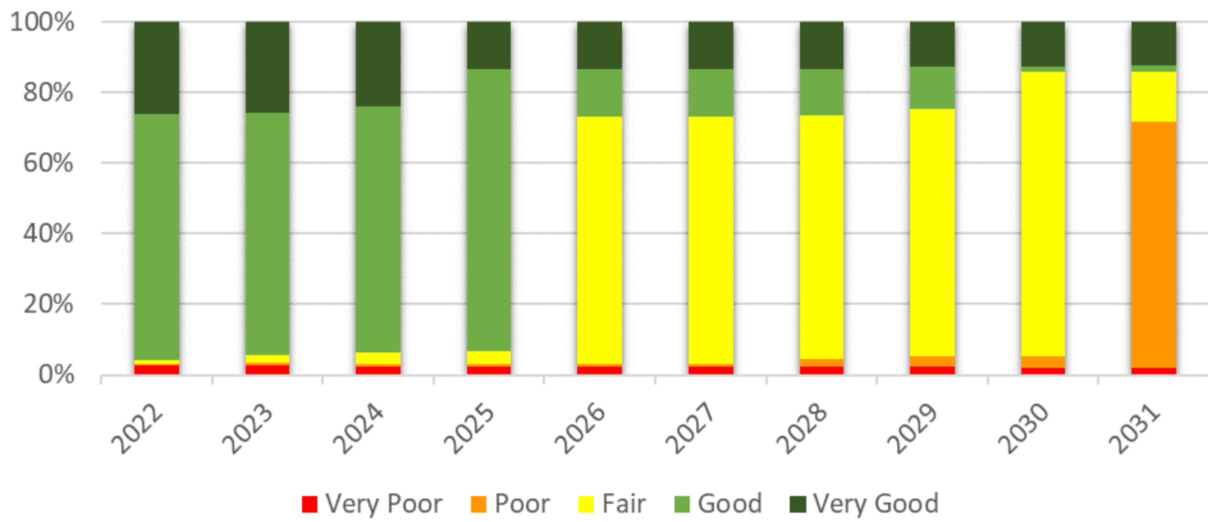

Figure 5-25: Street Lighting Performance Forecast with Cost to Maintain LOS

Scenario 3: Achieve LOS in 10 Years

The City has set its proposed LOS to be 100% of assets that have not exceeded their service life. The cost to meet this LOS in 10 years was determined to be $106K annually and resulted in the performance forecast illustrated in Figure 5-26.

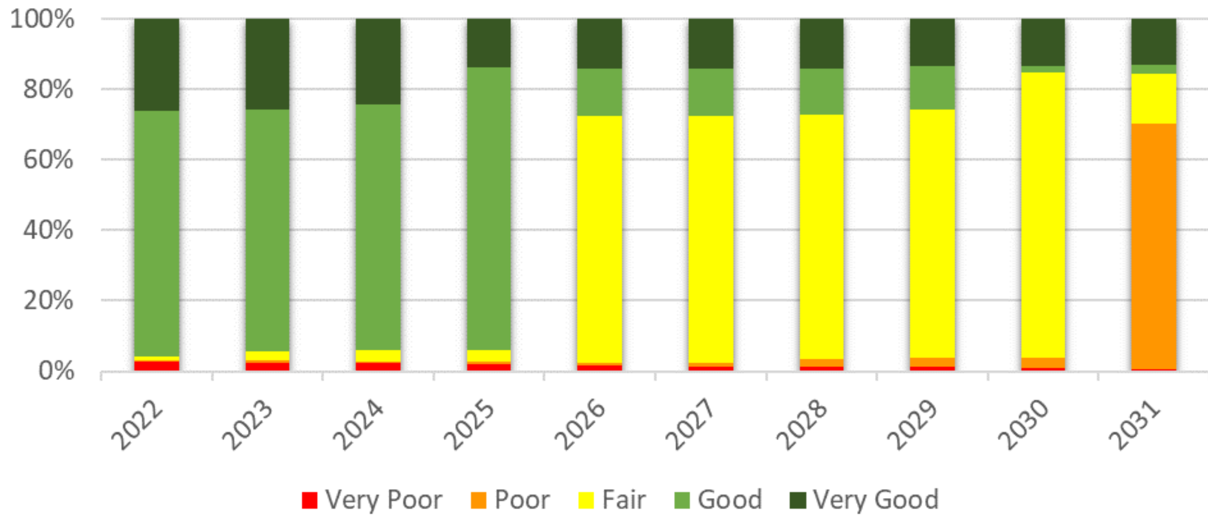

Figure 5-26: Street Lighting Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to meet the City's proposed LOS in 25 years was determined to be $1.5M annually and resulted in the performance forecast illustrated in Figure 5-27.

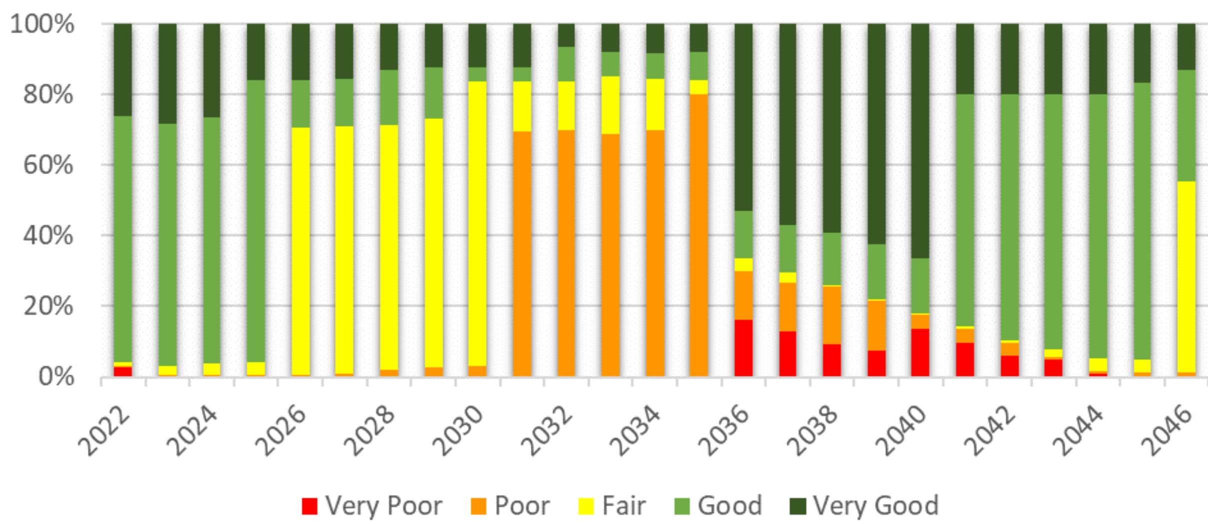

Figure 5-27: Street Lighting Performance Forecast with Cost to Achieve LOS in 25 Years

Note that fluctuations in the assets in very poor condition occur due to a concentration of needs that arises in certain years of the forecast period. This concentration is visualized in the backlog analysis below.

Scenario 5: Backlog Analysis

The backlog analysis indicated that a $1.2M backlog is present in Street Lighting assets. It also revealed that additional assets will require intervention over the 25-year forecast period. In particular, a significant number of street lights will require replacement in 2036. This is due to a large quantity of street lights that were installed at the same time, which the analysis identifies for replacement at the same time. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 5-28.

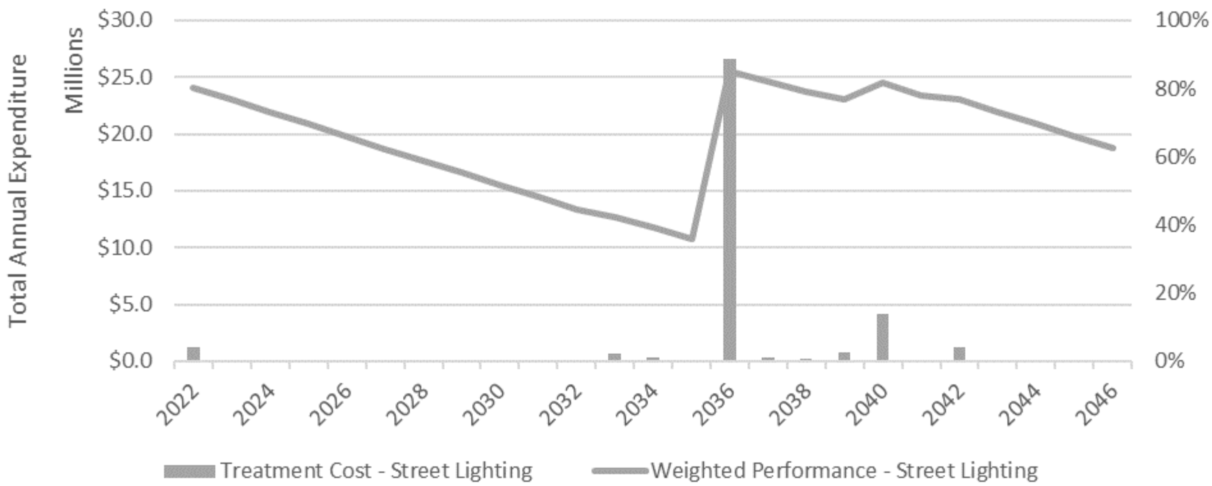

Figure 5-28: Street Lighting Backlog Analysis

5.2.8 Funding the Lifecycle Activities – Street Signs

Generally, the budget to replace street signs is low when compared to other, more expensive assets. Street signs can be replaced along with associated road works or as an operating cost item on an as-needed basis. As a result, to understand needs for the replacement of street signs, only the results from scenario 5: Backlog Analysis are reported here. Figure 5-29 illustrates these results.

Figure 5-29: Street Signs Backlog Analysis

5.2.9 Funding the Lifecycle Activities – Municipal Structures

The City uses the lifecycle strategies described in Section 5.2.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Municipal Structures assets was defined as the percentage of assets in fair or better condition.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments, $685K annually, resulted in the performance forecast illustrated in Figure 5-30.The percentage of assets percentage of assets in fair or better condition decreases from 98% to 90% over the 10-year forecast period.

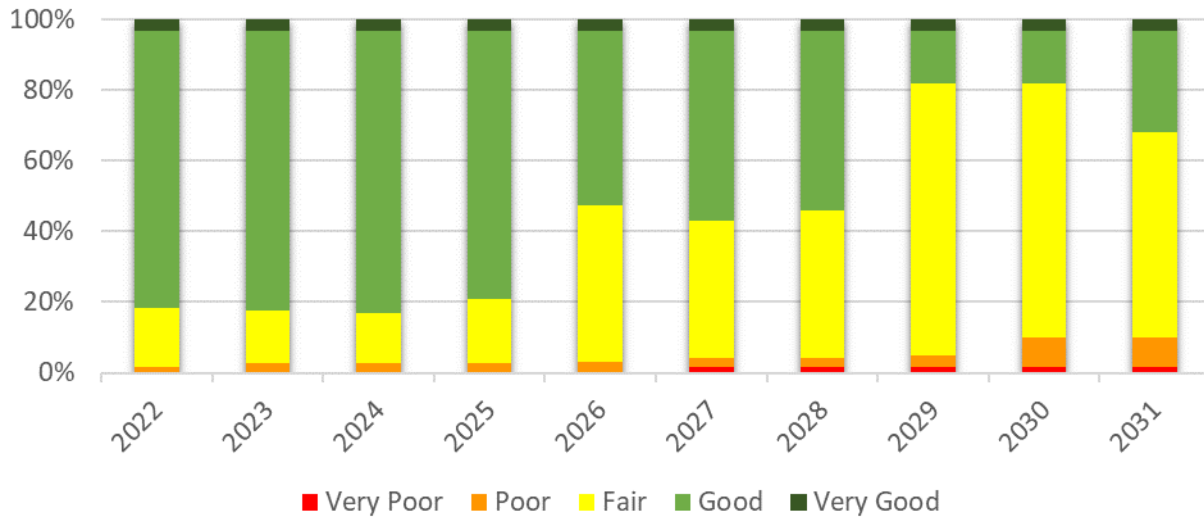

Figure 5-30: Municipal Structures Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost required to maintain existing service levels was determined to be $1.7M annually over a 10-year period and resulted in the performance forecast illustrated in Figure 5-31. The percentage of assets in fair or better condition remains around 98% in this scenario. This scenario included the required funds to perform most lifecycle activities to maintain the percentage of assets in fair condition (usually the range when rehabilitation occurs).

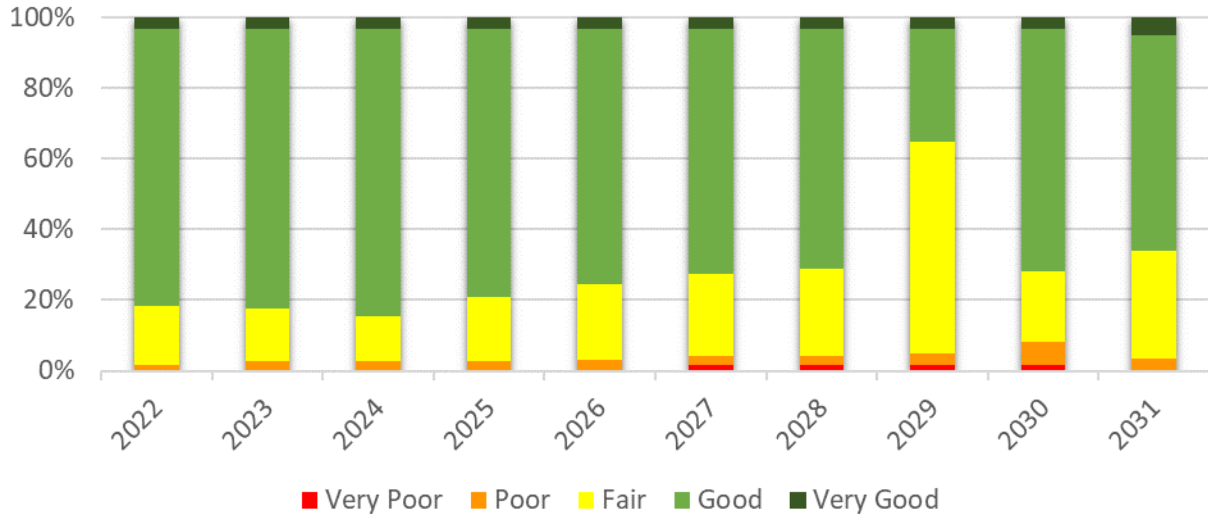

Figure 5-31: Municipal Structures Performance Forecast with Cost to Maintain LOS

Note that the key difference between this scenario and the current anticipated budget scenario is that this scenario includes budget for planned interventions, which will extend the life of these structures by completing rehabilitations along the asset lifecycle. Under the anticipated budget scenario, assets will deteriorate quicker, since rehabilitations will not be planned, resulting in more costly future repairs.

Scenario 3: Achieve LOS in 10 Years

The City has set the proposed LOS to be 100% of assets in fair or better condition. The cost to meet this LOS in 10 years was determined to be $1.8M annually and resulted in the performance forecast illustrated in Figure 5-32.

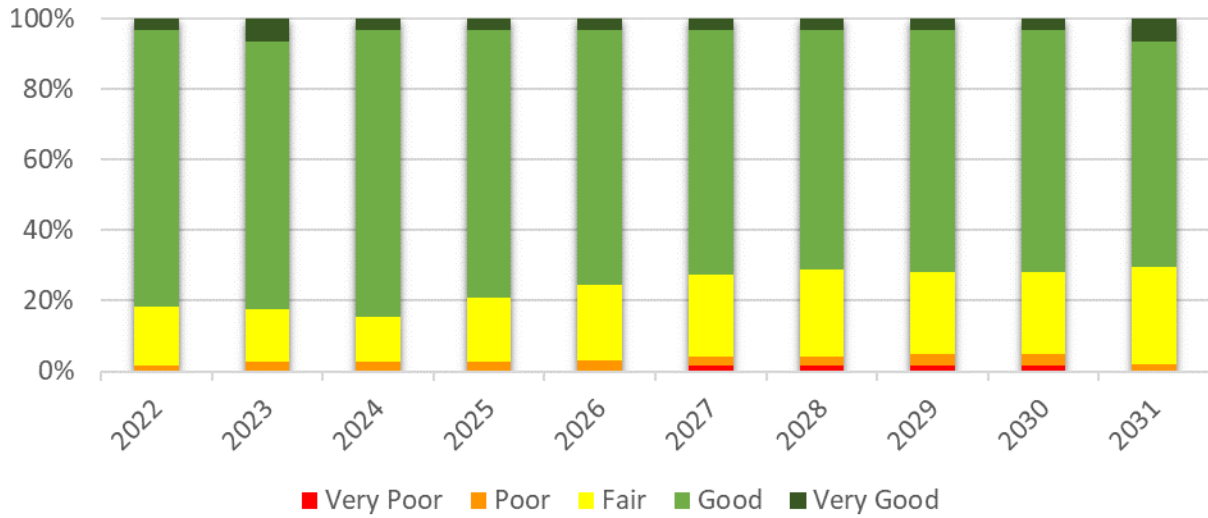

Figure 5-32: Municipal Structures Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to meet the LOS in 25 years was determined to be $1.2M annually and resulted in the performance forecast illustrated in Figure 5-33.

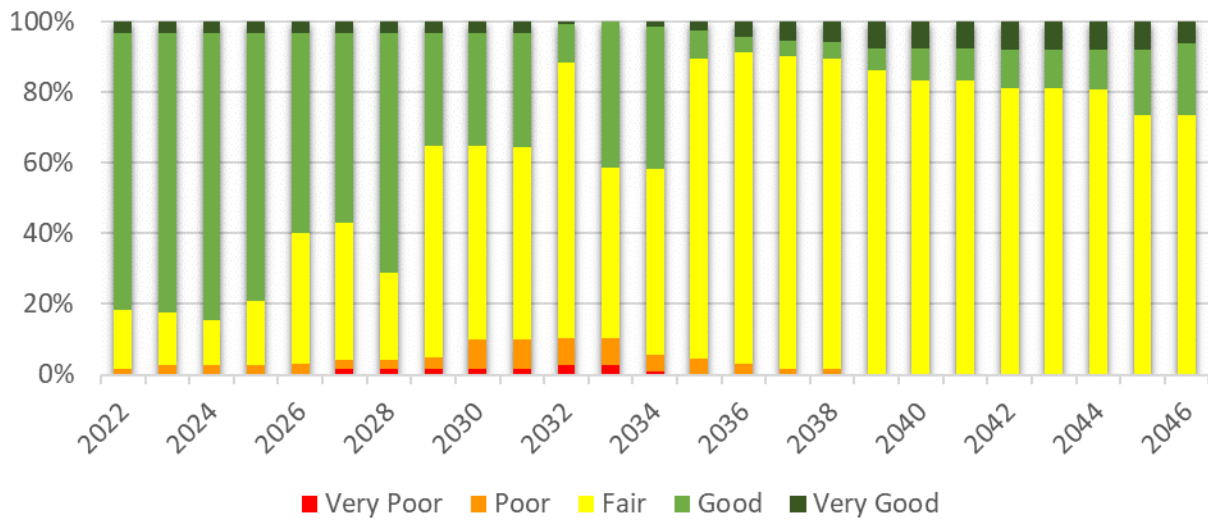

Figure 5-33: Municipal Structures Performance Forecast with Cost to Achieve LOS in 25 Years

Note that fluctuations in the assets in very poor condition occur due to a concentration of needs that arises in certain years of the forecast period. This concentration is visualized in the backlog analysis below.

Scenario 5: Backlog Analysis

The backlog analysis indicated that a $2.0M backlog is present in Municipal Structures assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance shown in Figure 5-34.

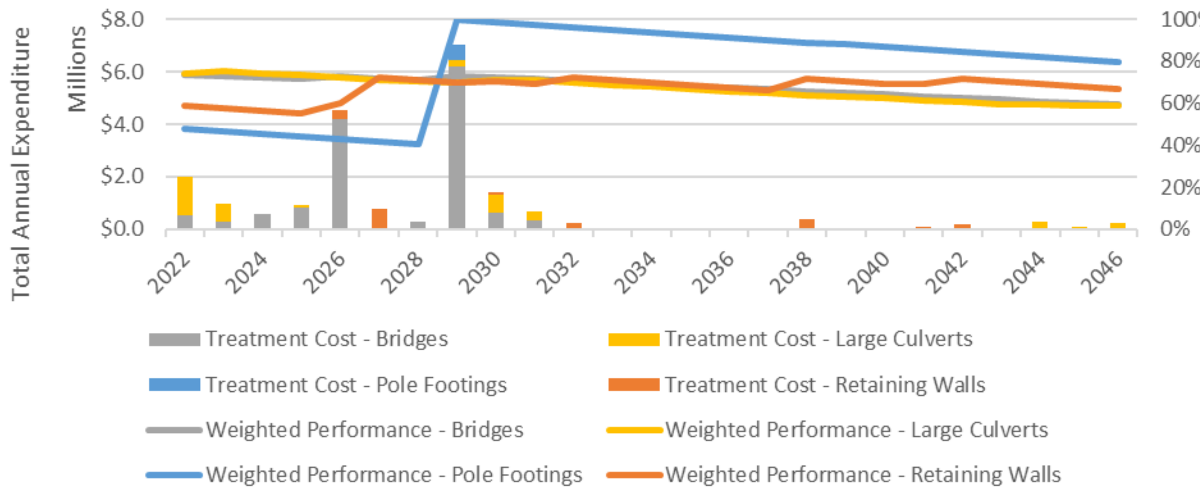

Figure 5-34: Municipal Structures Backlog Analysis

5.2.10 Recommendations

Roads and Small Retaining Walls

For roads and small retaining walls, the analyses determined that the City requires a significant increase in funding in order to meet service levels in both the 10 and 25-year forecast periods. The analyses indicates that the estimated annual funding is significantly lower to meet service level targets over the 25-year period when compared to the 10-year period. An annual budget increase of $500k would be required to meet service levels in the 25-year period. This is because the longer forecast period allows the backlog amount to be spread out further.

It is recommended that the City proceed with the budget detailed in Scenario 4 (Meet 100% LOS in 25-years), which is an investment of $6.0M annually. This will ensure that service levels are sustained in both the medium and long-term. It will also address the backlog in the forecast period.

The City has also completed an analysis of needs over a 50-year time period. This analysis indicated that funding under Scenario 4 will be sufficient to address the 50-year asset needs.

Small Culverts

The results of the various scenario analyses indicate that the needs to allocate $514K annually to meet service level targets in the medium-term (10-year) and $330K annually in the long-term (25 years). The replacement of culverts is optimized through coordination with other municipal works. As a result, the amount needed for culvert replacement can be reduced through this coordination.

Furthermore, note that the City evaluates culvert replacements to determine the most appropriate part to complete this work, which is either completed by City staff or by a contractor. The analysis assumes that all work is completed by a contractor. Where applicable (for example, for smaller culverts with lower traffic volumes), City staff may undertake the replacement works for a lower cost. It is recommended that the City develop a standard protocol for determining the most appropriate party (municipal staff vs. contracted services) to replace small diameter culverts.

It is recommended that the City proceed with the budget detailed in Scenario 4 (Meet 100% LOS in 25-years), which is an investment of $330K annually. This will ensure that service levels are sustained in both the medium and long-term. It will also address the backlog in the forecast period.

The City has also completed an analysis of needs over a 50-year time period. This analysis indicated that funding under Scenario 3 will be required to address the 50-year asset needs. Note that the required funding from Scenario 3 ($514K) is larger than from Scenario 4 (recommended scenario).

Traffic Signals and Pedestrian Crossings

The results of the various scenario analyses indicate that the City needs to allocate $635K annually to meet service level targets in the medium-term (10-year) and $546K annually in the long-term (25 years). It is recommended that the City proceed with the budget detailed in Scenario 4 (Meet 100% LOS in 25-years), which is an investment of $546K annually. This will ensure that service levels are sustained in both the medium and long-term. It will also address the backlog in the forecast period. The City has also completed an analysis of needs over a 50-year time period. This analysis indicated that current funding will be sufficient to address the 50-year asset needs.

Street Lighting

The results of the various scenario analyses indicate that the City is allocating sufficient funding at $175K annually to meet the LOS over the 10-year forecast period. Over the 25-year forecast period, the cost to meet the City's LOS is $1.5M annually. It is recommended that the City maintain its current budget allocation of $175K annually, but understanding its longer-term financial need consider lifecycle costing the asset. By contributing to a reserve over the life of the asset, the City would have the necessary funds to fund the asset's replacement at the end of life. The City also completed an analysis of needs over a 50-year period. This analysis indicated that funding under Scenario 4 ($1.5M annually) will be sufficient to address the 50-year asset needs.

Municipal Structures

The results of the various scenario analyses indicated that the City's current planned budget of $685K annually will result in a decrease in performance of its assets over the next 10 years (and beyond). Although this budget does not have a material impact on service levels (measured as a percentage of assets in fair or better condition), additional funding is required to meet the City's target LOS. The analyses indicate that the additional budget will enable the City to complete more rehabilitation works and extend the lifecycle of its municipal structure assets. It also should be noted that the City's rehabilitation and replacement strategy is based on the results of the OSIM inspections. Note that the OSIM inspections typically have a short or medium-term horizon. The City should consider increasing its funding to prepare for anticipated future needs.

Furthermore, the OSIM inspections provide funding recommendations tied to real inspections. The forecast model is theoretical and based on anticipated investment needs for the general case. Nevertheless, it is recommended that the City take a conservative approach to its investment needs, and plan for a larger investment in case needs arise over the medium and long-term.

5.3. ACTIVE TRANSPORTATION

The City of Cornwall is responsible for providing active transportation services pedestrians and cyclists vehicular, pedestrian and cycling traffic throughout the City. The City's active transportation network includes over 200km of sidewalks and paths. The City is responsible for maintaining these active transportation assets.

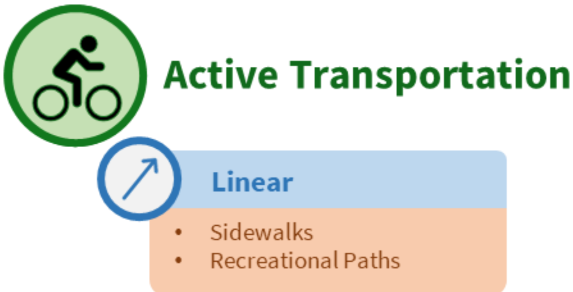

Figure 5-35. Asset Classes of the Active Transportation Network

This section documents the current state of active transportation assets, the LOS provided to citizens, the lifecycle activities performed on the assets, and the financial strategy required to deliver active transportation services. Note that bicycle lanes are physically a part of the City's road infrastructure. As a result, the state of infrastructure for bicycle lanes is documented with the Roads asset class in the Road Network subsection.

5.3.1 State of Infrastructure

Asset Inventory and Valuation

The replacement cost for the active transportation is approximately $47.3 million and is summarized in Figure 5-36 and Table 5-14.

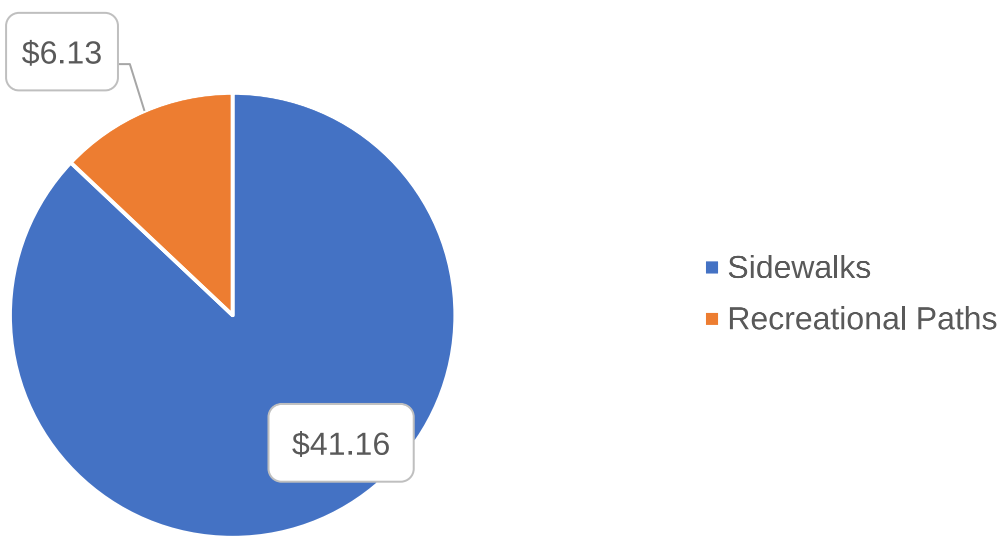

Figure 5-36: Active Transportation Valuation ($M)

Table 5-14: Active Transportation Asset Quantities

Category	Asset Category	Asset Class	Quantity	Replacement Cost
Active Transportation	Linear	Sidewalks	200.78 km	$41.16M
		Recreational Paths	41.74 km	$6.12M

Age Summary

The average age of assets compared to the average estimated service lives for the active transportation assets is provided in Figure 5-37. Presenting the asset portfolio in this manner provides a high-level understanding of the average age of assets relative to their lifecycles, which in turn can give an idea of overall condition based on age. The distribution of construction date is provided in Figure 5-38. Note that at present, the City is continuing to collect sidewalk PCR data with the goal of developing robust deterioration models/curves for sidewalks. As this process advances, then the City's understanding of sidewalk life expectancy will improve, and ESL values may change.

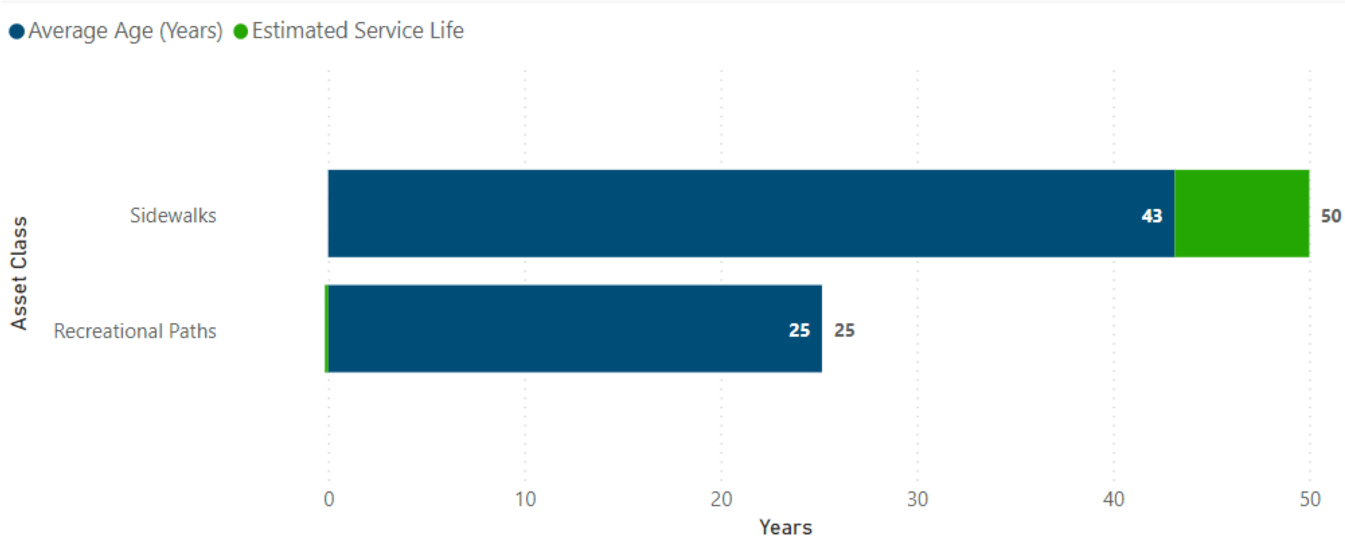

Figure 5-37: Active Transportation Average Age as a Proportion of Average ESL

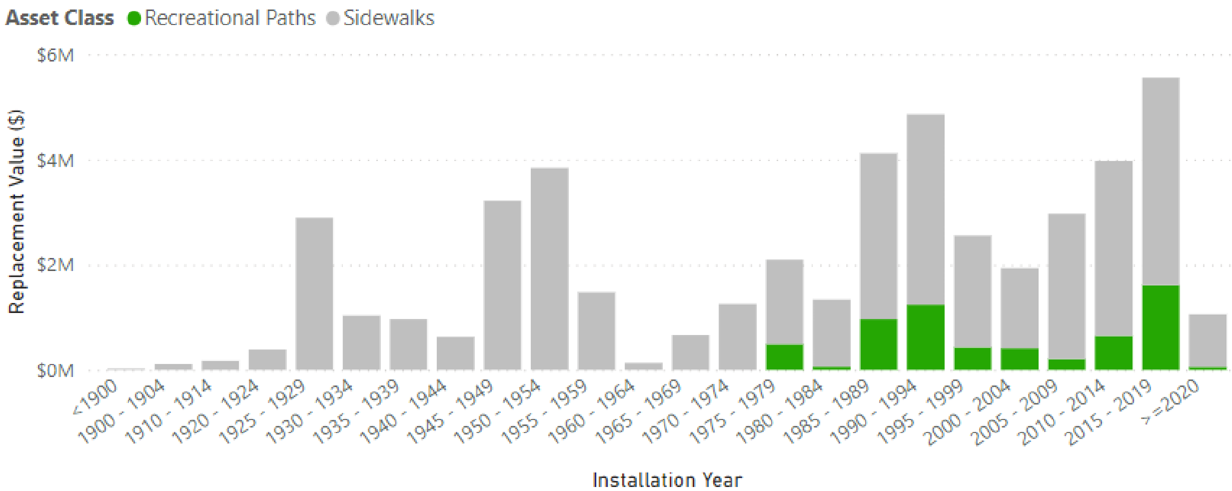

Figure 5-38: Active Transportation Construction Date Distribution

Asset Condition

The City has been assessing the condition of sidewalks and recreational paths using visual field inspections. Table 5-15 presents the logic used to convert life consumed into a condition rating. The condition distribution by replacement value is provided in Figure 5-39 and Figure 5-40. The accessibility of sidewalks is also tracked by the City. Sidewalks with 1.5m width meet the accessibility standards and are summarized in Figure 5-41.

Table 5-15: Active Transportation Condition Ratings

Category	Life Consumed	Sidewalks, Recreational Paths (Visual Inspection)
Very Good	0% to 25%	1
Good	25% to 50%	2
Fair	50% to 75%	3
Poor	75% to 100%	4
Very Poor	>100%	5

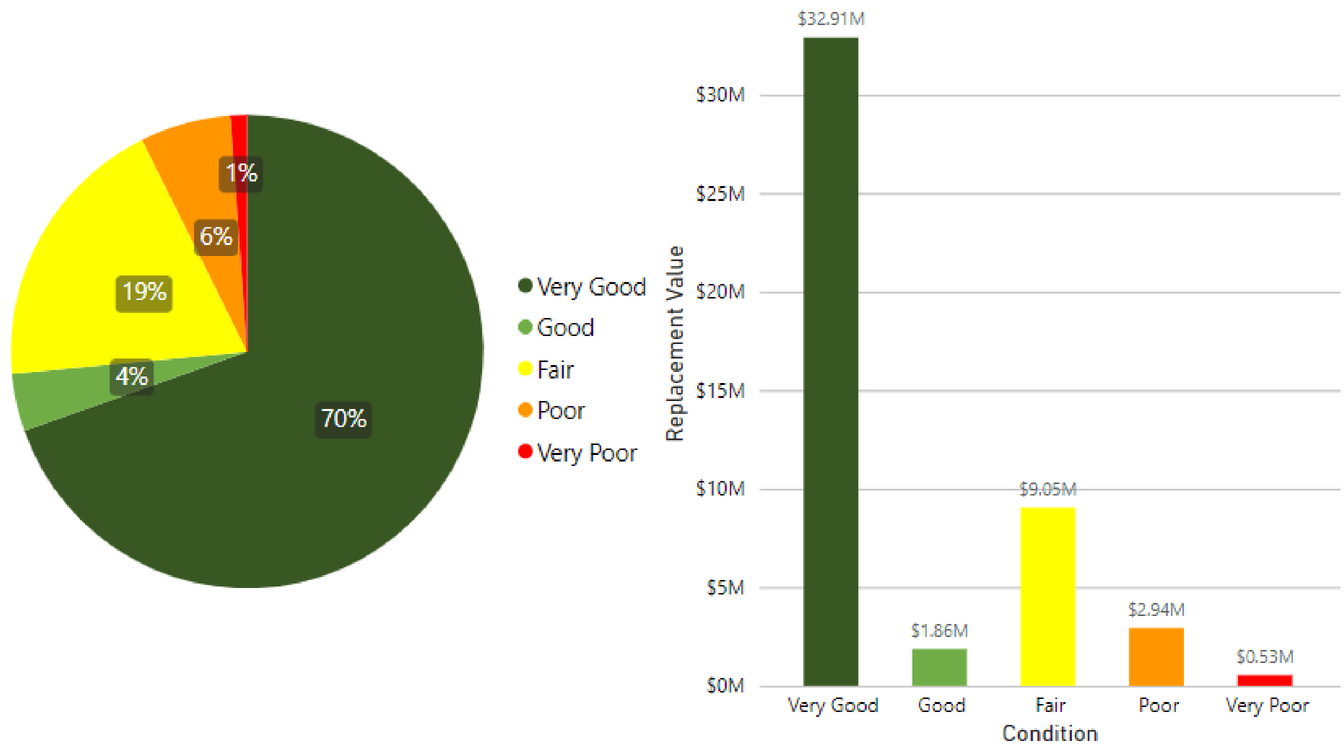

Figure 5-39: Active Transportation Overall Condition

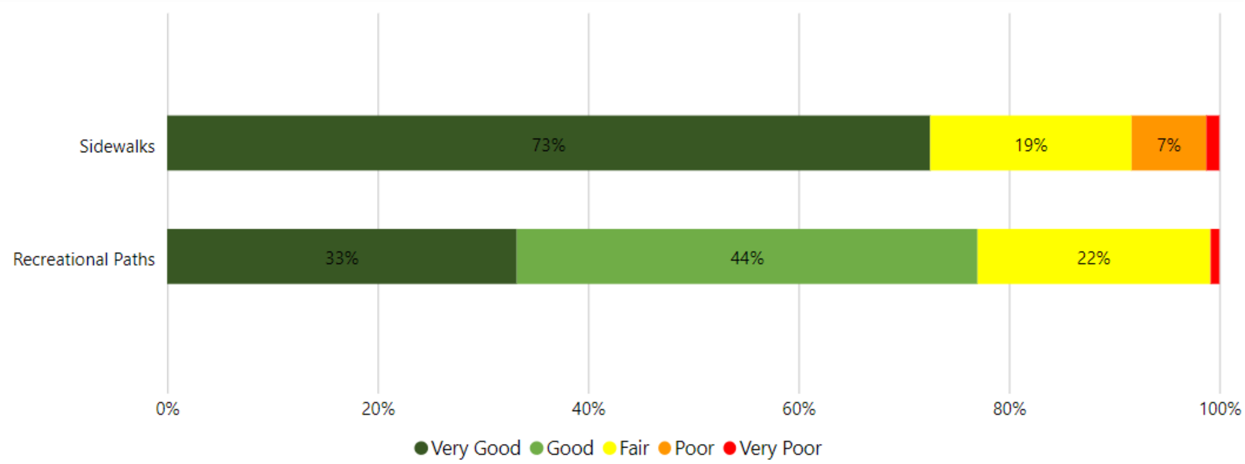

Figure 5-40: Active Transportation Condition Distribution by Replacement Value

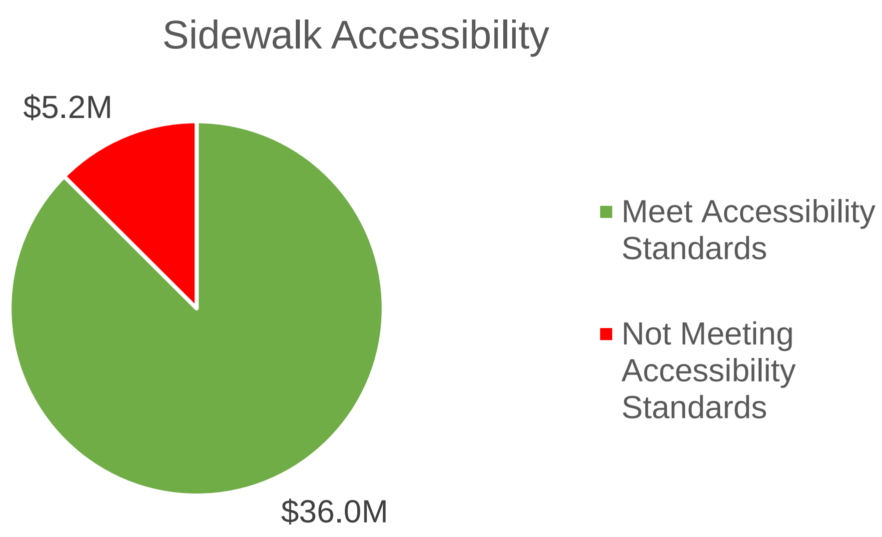

Figure 5-41: Sidewalk Accessibility Summary

Data Sources and Confidence

The data sources to support this state of the infrastructure analysis, as well as the other AM planning analyses required to complete this AMP is provided in Table 5-16.

Table 5-16: Road Network - Condition Data Collection

Asset Class	Condition Data Collection Technique	Frequency
Sidewalks	▪ Visual inspections as part of minimum maintenance standards	▪ Annually
Recreational Paths	▪ Visual inspections	▪ Biannually

The data completeness and confidence values for the aforementioned data is provided in Table 5-17.

Table 5-17: Road Network - Data Confidence

Asset Class	Completeness	Confidence	Comments
Sidewalks	**Good**	**High**	Very few data gaps. All assets were inspected 2021.
Recreational Paths	**Good**	**High**	Approx. 6% of assets missing condition data and inspection year At the time of writing this AMP. All assets were inspected late 2021 but were not included in this analysis.

5.3.2 Levels of Service

The City's goal is to provide an active transportation network that consists of sidewalks, bicycle lanes, and recreational paths that are convenient for pedestrians and cyclists to use, as well as reliable, accessible, and safe/operational. The City achieves these LOS by maintaining all assets in a state of good repair, meeting AODA requirements, and meeting minimum maintenance standards.

The community and technical LOS for the active transportation network are shown in Table 5-18 and Table 5-19. The measures are categorized in two types: Mandatory LOS measures as per O. Reg. 588/17, and foundational measures selected by the City.

	Represents a mandatory LOS measure as per O. Reg. 588/17
	Represents a Foundational Metric selected by the City

Table 5-18: Active Transportation Community Levels of Service

Subservice	Community Measures	Service Attributes	Current Performance
Active Transportation	Active Transportation network is convenient to travel on.	Reliable, Accessible, Safe, Operational	The City's active transportation network has a very high degree of reliability. Nearly all assets are meeting service level objectives for reliability. Accessibility targets are partially met for various asset classes. The City continues to build its active transportation network to ensure it is accessible and convenient to travel on. The City has also established future safety and operational technical LOS measures however, these are not measured at this time.

Table 5-19: Active Transportation Technical Levels of Service

Service Attribute	Performance Measure	Current Performance
Reliable	Percentage of sidewalks not past their service life[1]	99%
	Percentage of recreational paths not past their service life[1]	99%
Accessible	Percentage of sidewalk target objectives of constructed assets met	19%
	Percentage of sidewalks that meet AODA requirements	87%

Service Attribute	Performance Measure	Current Performance
	Percentage of recreational path target objectives of constructed assets met	25%

1. Asset effective age is evaluated based on recorded condition ratings.

5.3.3 Lifecycle Management Strategy

Lifecycle Activities

For the City to provide active transportation at the desired LOS, certain lifecycle activities are performed on the active transportation network. These include non-infrastructure solutions such as developing various plans and traffic studies; maintenance activities such as inspections, minimum maintenance; rehabilitation; resurfacing and replacement; asset and material disposal; and expanding and upgrading assets to support growth. Table 5-20 summarizes the lifecycle activities performed on sidewalks, bicycle lanes, and recreational paths.

Table 5-20: Active Transportation Lifecycle Activities

Lifecycle Activity	Description	Frequency
Non-Infrastructure	Planning and studies (Master Plans, financial plans, transportation studies, AMPs)	As required
Operations and Maintenance	Inspections as part of MMS	Annually
	Winter control (snow removal, de-icing)	As required
Rehabilitation	Grinding	As per Minimum Maintenance Standards
	Spot repairs	As per Minimum Maintenance Standards
	Asphalt Patching	As per Minimum Maintenance Standards
Replacement	Sidewalks: Full block replacements	• As per Minimum Maintenance Standards • Integrated with road resurfacing or reconstruction • Coordinated with road reconstruction or Active Transportation projects

Lifecycle Activity	Description	Frequency
	Bicycle lane resurfacing	• Integrated with road resurfacing or reconstruction • Coordinated with road reconstruction or Active Transportation projects
	Recreational path renewal	• Integrated with road resurfacing or reconstruction • Coordinated with road reconstruction or Active Transportation projects
Disposal	Disposed during construction	Coordinated with replacement works
Expansion/Service Changes	New sidewalks	As identified through master plans and studies
	New bike lanes	As identified through master plans and studies
	New recreational paths	As identified through master plans and studies

5.3.4 Funding the Lifecycle Activities – Sidewalks

The City uses the lifecycle strategies described in Section 5.3.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Sidewalk assets was defined as the percentage of assets that have not exceeded their service life.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current average anticipated investments, $291.7K annually, resulted in the performance forecast illustrated in Figure 5-42.The percentage of assets that have not exceeded their service life remains around 100% over the 10-year forecast period.

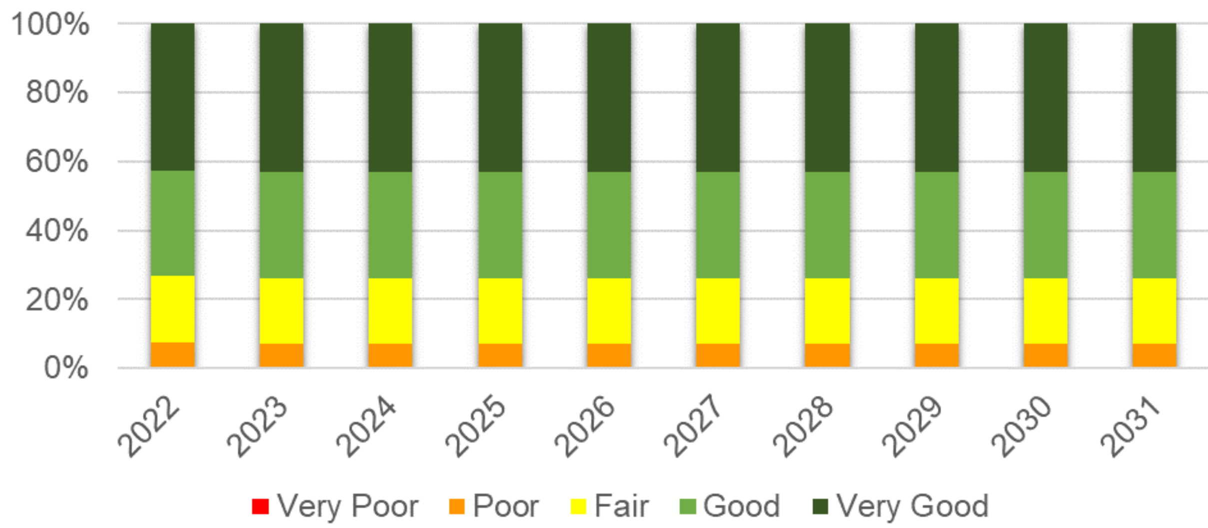

Figure 5-42: Sidewalks Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost to maintain LOS is a requirement of O.Reg.588/17. This scenario was determined to be $0K annually over a 10-year period and resulted in the performance forecast illustrated in Figure 5-48. The percentage of assets that have not exceeded their service life remains around 100% in this scenario.

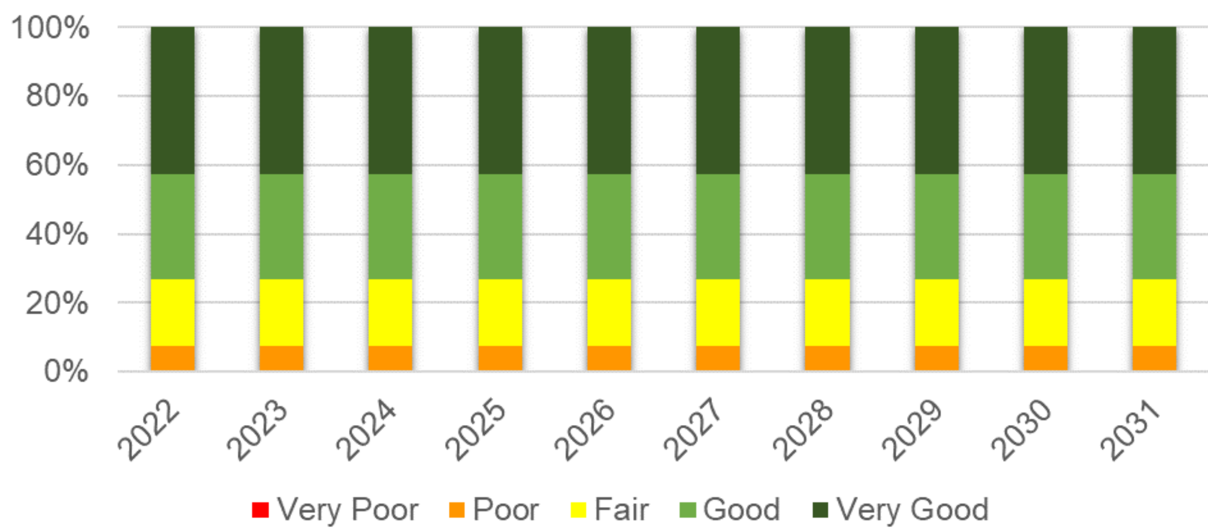

Figure 5-43: Sidewalks Performance Forecast with Cost to Maintain LOS

Scenario 3: Achieve LOS in 10 Years

The City has set the proposed LOS to be 100% of assets that have not exceeded their service life. The cost to meet this LOS in 10 years was determined to be $78.7K annually and resulted in the performance forecast illustrated in Figure 5-44.

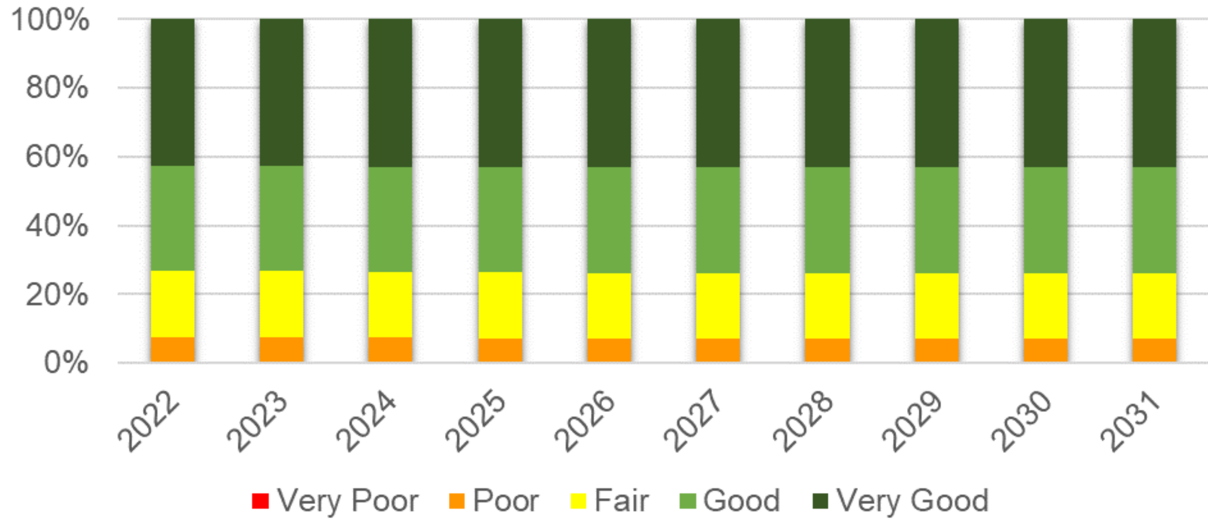

Figure 5-44: Sidewalks Performance Forecast with Cost to Achieve LOS in 10 Years

Scenario 4: Achieve LOS in 25 years

The cost to meet the LOS in 25 years was determined to be $438.7K annually and resulted in the performance forecast illustrated in Figure 5-45.

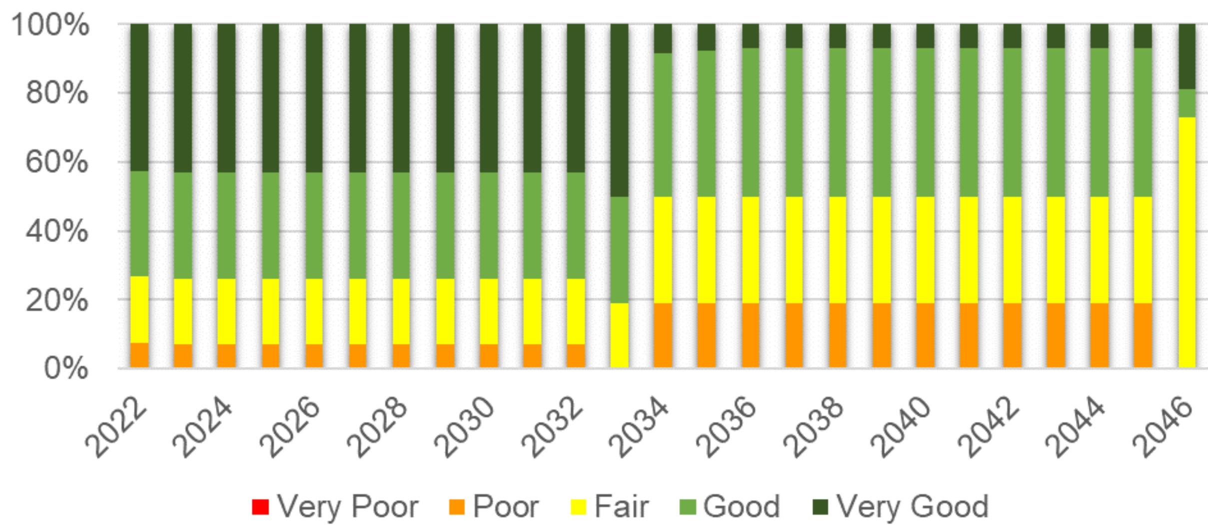

Figure 5-45: Sidewalks Performance Forecast with Cost to Achieve LOS in 25 Years

Scenario 5: Backlog Analysis

The backlog analysis indicated that a backlog of $509.4K or 2.5km is present in Sidewalks assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance illustrated in Figure 5-46.

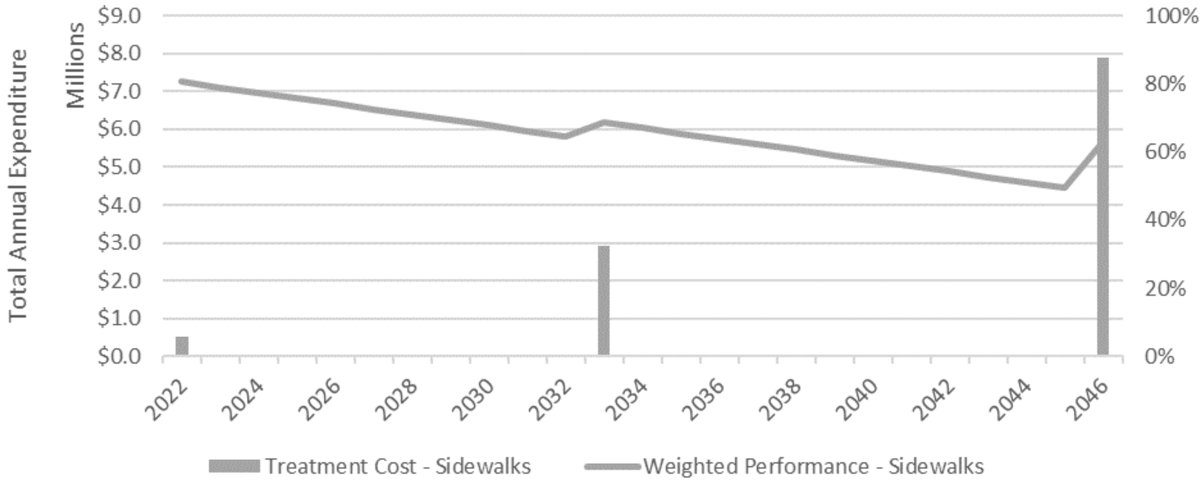

Figure 5-46: Sidewalks Backlog Analysis

5.3.5 Funding the Lifecycle Activities – Recreational Paths

The City uses the lifecycle strategies described in Section 5.3.3 to plan work and determine future expenditure needs. The technical LOS used in the AM analysis for Recreational Paths assets was defined as the percentage of assets that have not exceeded their service life.

Each of the scenarios, and its purpose in the overall analysis, is discussed in Subsection 2.5.3. Refer to Subsection 2.5.3 for detailed descriptions on the five scenario types.

Scenario 1: Anticipated Budget

The current planned budget was analyzed to set a baseline for comparing the achieve LOS scenarios. The current average anticipated investments, $50K annually, resulted in the performance forecast illustrated in Figure 5-47.The percentage of assets that have not exceeded their service life remains goes from 100% to 67% over the 10-year forecast period.

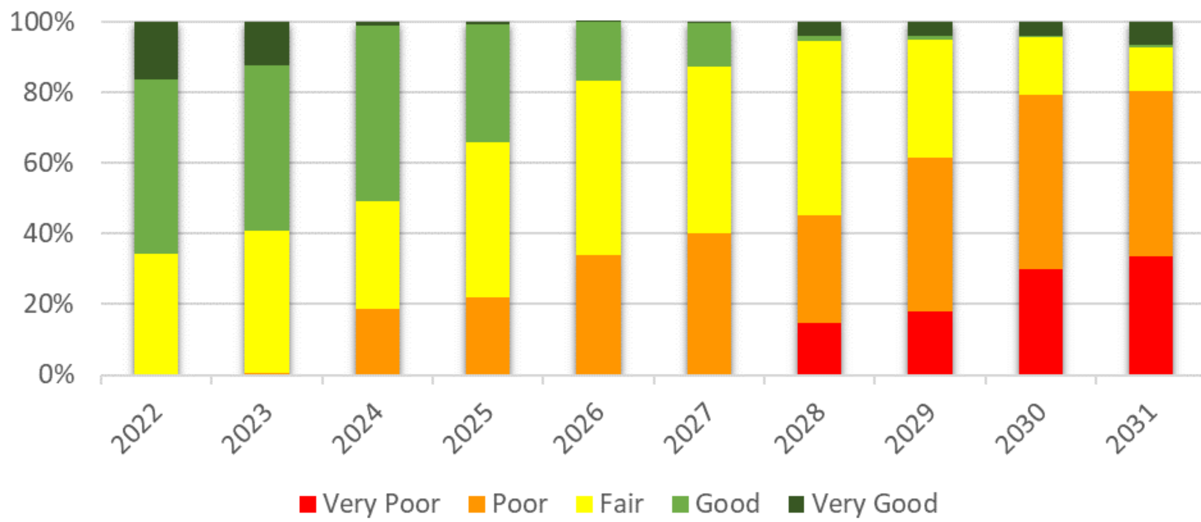

Figure 5-47: Recreational Paths Performance Forecast with Anticipated Budget

Scenario 2: Cost to Maintain LOS

The cost to maintain LOS is a requirement of O.Reg.588/17. This scenario was determined to be $63.5K annually over a 10-year period and resulted in the performance forecast illustrated in Figure 5-48. The percentage of assets that have not exceeded their service life remains around 100% in this scenario.

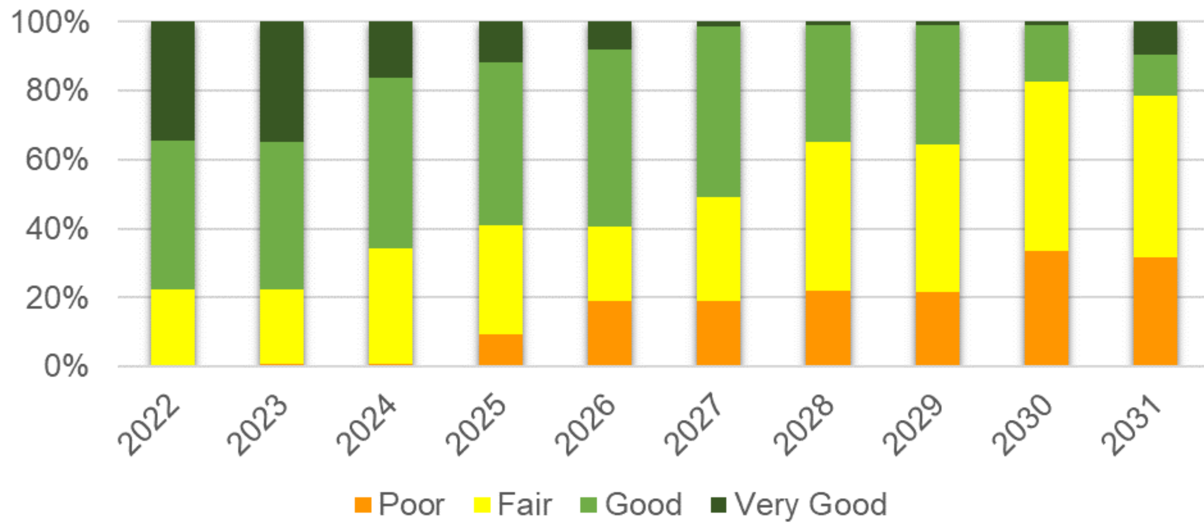

Figure 5-48: Recreational Paths Performance Forecast with Cost to Maintain LOS

Scenario 3: Achieve LOS in 10 Years

The City has set the proposed LOS to be 100% of assets that have not exceeded their service life. This is also the City's current performance. Therefore, the results of Scenario 2 and Scenario 3 are the same. As described above, $63.5K annually maintains this LOS over the 10-year period. Figure 5-48 (above) illustrates the performance forecast for this scenario.

Scenario 4: Achieve LOS in 25 years

The cost to meet the LOS in 25 years was determined to be $226.4K annually and resulted in the performance forecast illustrated in Figure 5-49.

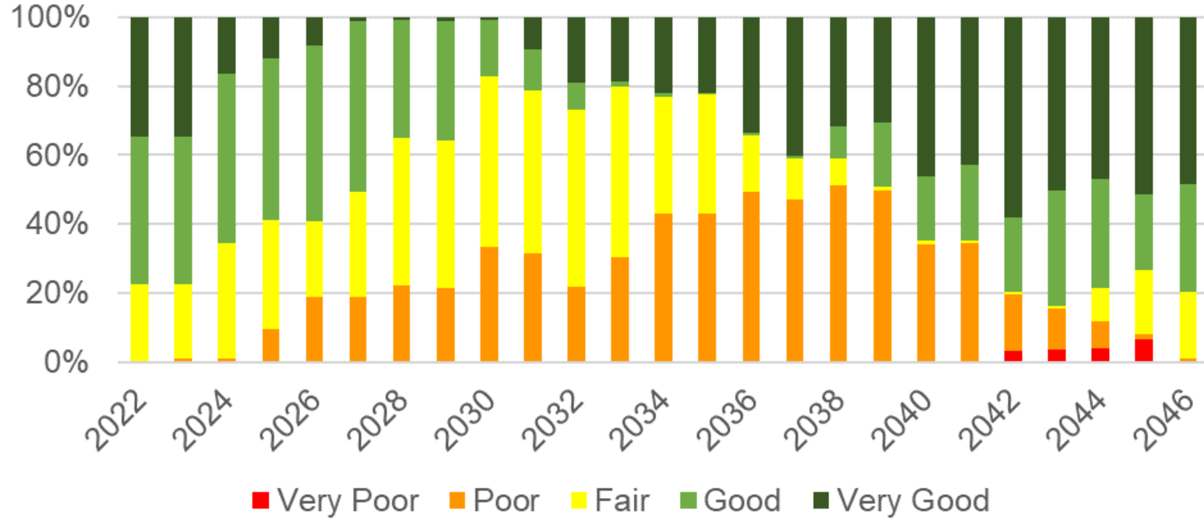

Figure 5-49: Recreational Paths Performance Forecast with Cost to Achieve LOS in 25 Years

Scenario 5: Backlog Analysis

The backlog analysis indicated a backlog of only $29.5K (or 0.6km) is present in Recreational Paths assets. It also revealed that additional assets will require intervention over the 25-year forecast period. The backlog analysis resulted in the expenditure distribution and average performance shown in Figure 5-50.

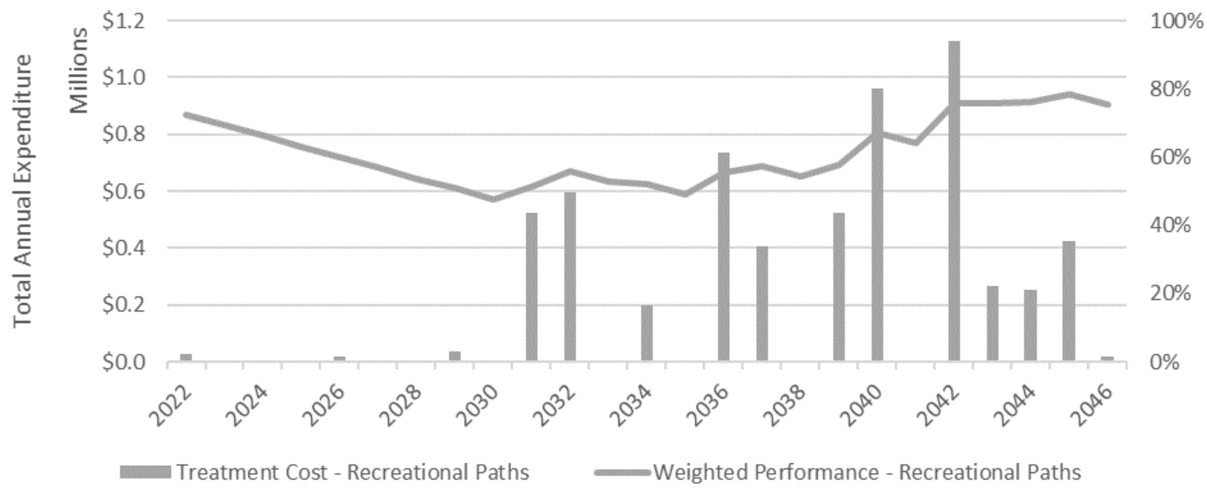

Figure 5-50: Recreational Paths Backlog Analysis

5.3.6 Recommendations

The results of the various scenario analyses indicate that the City requires additional funding to meet its target service levels in both the medium and long-term for both sidewalks and recreational paths.

It is recommended that the City proceed with the budgets detailed in Scenario 4 (Meet 100% LOS in 25-years), which is an investment of $665.1K annually ($438.7K for Sidewalks and 226.4K for Recreational Paths). This will ensure that the City meets its service level targets in both the medium and long-term. Note that this scenario results in the replacement of all Very Poor and nearly all Poor condition Sidewalks and Recreational Paths by the end of this time frame.

The City has also completed an analysis of needs over a 50-year time period. This analysis indicated that funding under Scenario 4 will be sufficient to address the 50-year asset needs.

The City uses a condition rating system to assist them in determining the appropriate time for intervention. This system equates a condition rating of 5 – Very Poor (VP) to an asset that has reached its ESL. The City also wishes to consider the investment need of replacing Sidewalks and Recreational Paths when they reach a condition rating of 4 – Poor (P). The following table illustrates these needs.

Table 5-21: Active Transportation Assets Needs Comparison

Asset Class	Backlog of Poor and Very Poor Assets	Replace Very Poor Assets (10-years)	Replace Poor and Very Poor Assets (10-years)	Replace Very Poor Assets (25-years)	Replace Poor and Very Poor Assets (25-years)
Sidewalks	16.7 km	$78.7K	$343.4K	$438.7K	$452.5K
Recreational Paths	0.2 km	$63.5K	$254.9K	$226.4K	$245.1K
Total	**16.9 km**	**$142.2K**	**$598.3K**	**$665.1K**	**$697.6K**

6. GROWTH CONSIDERATIONS

The City's 2017 Development Charge Background Study thoroughly assessed the impact of growth on demand and the resulting capital and significant operating expenditures that are anticipated for core assets to 2037. These forecasts, results and recommendations are used in the asset management discussions for each asset category. For this AMP, the focus of growth projections has been the net capital costs (costs to be incurred by the City), and the operational impact.

The City's 2016 population was 46,589 people. The City's population is anticipated to reach 49,400 by mid-2037, representing a 6% increase. The total number of households for the City is anticipated to reach 23,080 by mid-2037, representing a 10% increase from 2016 levels.

Table 6-1: City of Cornwall Population Forecast

	Year	Population (Excluding Census Undercount)	Population (Including Census Undercount)[1]	Total Households	Person Per Unit (PPU)
Historical	Mid 2001	45,640	47,120	19,025	2.40
	Mid 2006	45,965	47,450	19,705	2.33
	Mid 2011	46,340	47,840	20,445	2.27
	Mid 2016	46,589	48,098	20,930	2.23
	Mid 2021	47,845[2]	-	22,406	-
Forecast	Mid 2022	47,383	48,920	21,801	2.17
	Mid 2027	48,139	49,700	22,394	2.15
	Mid 2032	48,907	50,490	22,765	2.15
	Mid 2037	49,400	51,000	23,080	2.14

Source: Watson & Associates Economists Ltd., 2017. Derived from City of Cornwall Municipal Comprehensive Review Phase 1 Population, Housing and Employment Forecast, 2011 – 2036

1. Census Undercount estimated at approximately 3.2%. Note: Population including the undercount has been rounded.

2. Original source forecasts were updated to include 2021 Census information. Note that the population value for 2021 is the census number, and future forecasts were sourced from the 2017 study.

The City's Employment Forecasts from the 2017 Development Charge Background Study are provided in the table below. The City is anticipated to have an increase in employment of approximately 11% from 2017 (year of the study), to 2037.

Table 6-2: City of Cornwall Employment Forecast

	Year	Employment (Total)
Historical	Mid 2001	22,051
	Mid 2006	21,996
	Mid 2011	24,190
	Mid 2017	24,786
Forecast	Mid 2022	25,499
	Mid 2027	26,323
	Mid 2032	27,260
	Mid 2037	27,554

Source: Watson & Associates Economists Ltd., 2017.
2001-2006 Employment based on statistics Canada census employment data.
2011 derived based on 2011 EMSI data for the City of Cornwall

Growth will likely correspond to increased demand on Utilities and Transportation Services assets, which could result in increased deterioration of assets and a reduction in service levels if not addressed. Maintaining capacity and quality, especially with climate change, may also present a challenge as the City's population and household formation increase.

The City will increase its asset portfolio to accommodate the increase in population through new development. This will also result in additional financial and non-financial resources to operate and manage the lifecycle activities associated with these new assets.

Further information on growth planning can be found in the 2017 Development Charge Background Study. The City's Financial Strategy contained within this AMP details the City's forecasted growth plan for these in-scope assets to expand its asset portfolio and accommodate the expected population increase. Population growth creates a need for the expansion of construction of infrastructure, which in turn results in additional asset lifecycle needs, including operating/ maintenance and eventually renewal. These costs have been incorporated into the expansion, operations and maintenance lifecycle activities in this AMPs Financial Strategy.

7. FINANCIAL STRATEGY

7.1. INTRODUCTION

The financial strategy of this AMP aims to identify the appropriate funding levels required to provide the intended LOS. It takes into consideration revenues, operating and capital expenditures, debt, and any future commitment for all the asset classes in the plan. It outlines the suggested financial approaches to funding the City's recommended strategies to address asset lifecycle needs and maintain service levels. It is not intended to be a capital plan, prescribing projects to be completed but rather to ensure that funding levels are enough to achieve the proposed LOS over the 10 or 25-year period.

As part of the City's AMP development, the City also developed a Risk Management Strategy, to assess risk against its assets. This helped the City understand asset needs from a combined lifecycle and risk-based approach, for which to complete its financial forecasts.

The City's budgets are developed to allocate the necessary funding to provide services, maintain, and construct infrastructure assets. These are based on required costs (expenditures) and available funding (revenues). The City allocates a portion of their revenues from property taxes as well as water and wastewater rates to support current year projects, contribute to reserves, and make debt repayments for past capital projects.

Property taxes fund the City's core asset programs and services including transportation, active transportation, and right-of-way maintenance. Water, Sanitary, Storm and Combined Systems are funded by water and wastewater rates.

In this section, the asset classes are summarized into the following three categories:

- **Wastewater:** Includes all linear and vertical wastewater and stormwater assets, excluding the Wastewater Treatment Plant.
- **Water:** Includes all watermain assets, does not include the Water Purification Plant, Reservoirs and Elevated Storage Tanks.
- **Taxation:** Includes all road network and active transportation assets.

In terms of expenditures, the City categorizes their budget into the following:

- **Operating budget:** Supports the day-to-day activities and functions conducted to provide City services. Samples of the expenditures funded from the operating budget include staff salaries, equipment maintenance, materials supply, and facilities services. These are expensed within the fiscal year.
- **Capital budget:** A comprehensive financial plan that addresses the financial requirements of growth and the renewal and replacement of existing infrastructure.

As part of the annual budget development process, the City ensures continued financial sustainability through effective financial planning and risk management. The City will use one or more of these financial strategies to fund its projects:

- **Pay as you go**: Saving funds in advance to acquire an asset. This strategy often requires sacrificing short-term needs to retain funds long-term for a larger capital project.
- **Financing**: A loan issued to acquire an asset which requires annual repayments with interest (limited to an annual payment limit or 25% of the City's own source revenue, as per O.Reg. 403/02). The City practices an internal policy of 10% of own source revenue and it is considered to be an important avenue for financing capital projects while practicing good budget management.
- **Reserve Accounts**: Contributing to a reserve account to maintain a threshold for unexpected costs and to save for larger planned projects.
- **Government Grants:** Funding provided by Provincial and Federal Governments.
- **Development Charges:** Subsidies from development for growth related projects.
- **User Fees**: Fees from the user of a service.

The City uses short- and long-term strategies to ensure fiscal responsibility and provide the necessary services to the residents and businesses of Cornwall. This includes the continued preparation and distribution of the 10-year capital plan allocations.

Procurement strategies also form part of the City's financial plan to meet service levels and address backlogs. The City actively engages in project bundling wherever possible and feasible. This primarily applies to linear "corridor" assets, which include assets within the road right of way, such as roads, watermains, sanitary sewers, storm sewers and/or combined sewers. By bundling these asset replacements together, the City can take advantage of cost efficiencies.

The following section details the financial results of each scenario analyzed for this AMP, as well as asset backlogs and shortfalls/excess. It discusses various strategies and avenues to fund asset shortfalls, as well as risks associated with the lifecycle activities under each strategy. It also discusses the consequences of deferring work and not addressing backlog. The results of this AMP and financial strategy are expected to be used to inform the City's Long-Term Financial Plan. The Long-Term Financial Plan, which is to be updated in Spring of 2023, will further provide the City with specific strategies to fund shortfalls.

7.2. RISKS AND MITIGATIONS

This section summarizes the risks associated with the lifecycle strategies and funding analyses/recommendations, as detailed in the sections above. Risks are described below, and potential mitigation strategies are also discussed.

Data Confidence

The asset management analyses completed as part of this AMP are reliant on the City's asset and financial data. The confidence of that data affects the confidence of the results of each analysis. Data confidence, with respect to key asset management data, is detailed for each major asset class in the sections above. Overall, most of the data was complete and had high confidence. The asset classes that could improve were sanitary pumping stations, oil grit separators, traffic signals, street lighting and pedestrian crossings. Data/condition information is available for these asset classes; however, it has not been digitized and incorporated into the City's GIS system and applicable databases.

The City also is enacting a strategy to continue to update, maintain and improve asset data, which has been developed as part of this AMP development. The City's *Data and Condition Assessment Plan* (**Appendix B**) provides the City with a plan to ensure that its data is continually improved.

Due to the high confidence of the City's data, this risk is considered to be low.

Funding and Costs

Through the analyses within this AMP, the City has identified several asset classes that require additional funding in order to meet LOS targets. Without an increase in funding, the City could risk operating at a lower LOS. At the time of writing this AMP, this risk is being managed through enacting recommendations from past AMPs, which has resulted in a reduction of backlogs and the majority of asset classes providing a LOS that meets public expectations.

COVID-19

The current environment also contains a degree of uncertainty, due to the COVID-19 pandemic. The economic environment that has seen phenomena such as supply chain constraints, construction delays, and a rise in inflation to high levels at the time of writing of this AMP. These uncertainties may result in economic pressures that could increase the financial impact of maintaining and replacing infrastructure.

Climate Change

Climate change also poses a significant risk to the City. The effects of climate change could result in impacts to assets that would require additional funding from the City. Impacts could include increased risk of failures, accelerated deterioration or a reduction in capacity of some assets that are impacted by the effects of climate change.

Climate change hazards, including increased precipitation, heat waves and other changes to the elements could change the City's needs and ultimately result in impacts to its financial strategy.

The City is currently preparing a Climate Action Plan and is implementing changes to start mitigating risks associated with climate change. A sustainability coordinator has been hired to lead the project and help facilitate the implementation.

It is recommended that the City endeavors to complete climate change analysis to determine the potential effects on infrastructure, and possible strategies to ensure that the City continues to work towards meeting its service level objectives.

Regulatory Environment

There are also some risks associated with a changing business environment. Regulatory changes could impact the way that the City renews and replaces its infrastructure. These risks are generally considered to be low, since the City endeavours to keep current with regulation changes, and incorporate them into its planning, which ensures that assets are up to date with the current regulatory environment. This means that the City will be adequately equipped to adapt to any future regulatory changes.

7.3. TOTAL PORTFOLIO REPLACEMENT VALUES/BACKLOGS

The results of the various asset management analyses completed as part of this AMP development are summarized in the following tables. Each table summarizes replacement values, current backlogs and backlogs as a percentage of replacement values for each asset grouping.

Backlogs were developed through a decision support analysis, which combines asset installation dates, current condition, lifecycle models and LOS targets in order to determine asset needs. Current backlog is represented as the amount of immediate work that is required (not including additional work that may occur over the forecast periods) to meet the City's LOS targets. 6

Table 7-1: Replacement Value and Backlog Summary

Category	Replacement Value	Current Backlog	Backlog as % of Replacement Value
Wastewater	$637,900,000	$22,716,000	4%
Water	$345,900,000	$51,600,000	15%
Taxation	$582,000,000	$79,038,500	14%

Replacement values for sanitary, storm and combined linear sewer assets were developed using unit replacement costs, based on asset diameters and material types. These unit costs were applied to each pipe segment in the City's asset register to determine an overall replacement cost for all wastewater assets. Vertical asset replacement costs were obtained from the City's wastewater and stormwater asset inventories.

Table 7-2: Replacement Value and Backlog Summary – Wastewater

Asset Subservice	Replacement Value	Current Backlog	Backlog as % of Replacement Value
Sanitary Linear	$224,900,000	$7,300,000	3%
Sanitary Vertical	$8,500,000	$0	0%
Combined Linear	$197,000,000	$14,000,000	7%
Storm Linear	$204,500,000	$1,400,000	1%
Storm Vertical	$3,000,000	$16,000	1%
Total Wastewater	**$637,900,000**	**$22,716,000**	**4%**

Replacement cost for water linear assets were developed using unit replacement costs, based on asset diameters and material types. These unit costs were applied to each pipe segment in the City's asset register to determine an overall replacement cost for all waster linear assets.

Table 7-3: Replacement Value and Backlog Summary – Water

Asset Subservice	Replacement Value	Current Backlog	Backlog as % of Replacement Value
Linear	$345,900,000	$51,600,000	15%
Total Water	**$345,900,000**	**$51,600,000**	**15%**

Replacement cost for roads linear assets were developed using unit replacement costs, based on roads asset widths and composition (i.e. material types). These unit costs were applied to each road segment in the City's asset register to determine an overall replacement cost for all roads linear assets. Replacement costs for traffic management and other roads assets (such as small culverts and small retaining walls) were obtained from the City's asset inventories. Replacement costs for municipal structures assets were obtained from the City's biennial OSIM inspection reports.

Table 7-4: Replacement Value and Backlog Summary – Taxation

Asset Subservice	Replacement Value	Current Backlog	Backlog as % of Replacement Value
Roads and Small Retaining Walls	$390,700,000	$68,700,000	18%
Small Culverts	$18,300,000	$2,400,000	13%
Traffic Signals and Pedestrian Crossings	$13,400,000	$4,200,000	31%
Street Lighting	$40,000,000	$1,200,000	3%
Municipal Structures	$72,300,000	$2,000,000	3%
Sidewalks	$41,200,000	$509,000	1%
Recreational Paths	$6,100,000	$29,500	0%
Total Taxation	**$582,000,000**	**$79,038,500**	**14%**

7.4. CAPITAL AND MAINTENANCE BUDGET FORECASTS

The following tables illustrate the City's capital and maintenance budget forecasts for the Wastewater, Water and Taxation asset groupings. Each forecast contains breakdowns of budget costs including:

- Expansion: The activities required to accommodate growth and the associated expansion of infrastructure.
- Non-infrastructure: Activities undertaken to increase the service life of assets, that are not direct maintenance or renewal works.
- Renewal: Major rehabilitations/repairs and asset replacements that increase or restore the asset's service life.
- Service Changes: Activities that are required to accommodate regulatory changes, or otherwise improve asset function/service provisions, and are not specifically related to asset condition.
- Total Capital Activities: The total amount for all capital forecasts.
- Total Operating Activities: The total amount for all operating activities, including maintenance and asset operation.

Wastewater

Table 7-5: Capital and Maintenance Budget Forecasts – Wastewater ($000's)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Expansion	0	3,750	0	0	0	0	0	0	0	0
Service Changes	0	0	0	0	0	0	0	0	0	0
Renewal	2,463	2,550	2,538	2,569	2,614	2,665	2,716	2,768	2,813	2,813
Non-Infrastructure	0	0	0	0	0	0	0	0	0	0
Total Capital Activities	**2,463**	**6,300**	**2,538**	**2,569**	**2,614**	**2,665**	**2,716**	**2,768**	**2,813**	**2,813**
Total Operating Activities	**2,262**	**2,319**	**2,377**	**2,436**	**2,497**	**2,559**	**2,623**	**2,689**	**2,756**	**2,825**

Wastewater asset budget forecasts generally remain steady over the next 10 years. The City has forecasted an expansion need in 2023, which represents the business park expansion. The City does not have any forecasts for service changes or non-infrastructure activities.

Operating budget forecasts are projected to increase moderately over time, to account for the additional expenses associated with the acquisition of new assets (expansion), as well as the aging of existing assets.

Water

Table 7-6: Capital and Maintenance Budget Forecasts – Water ($000's)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Expansion	500	4,250	500	500	500	500	500	500	500	500
Service Changes	0	0	0	0	0	0	0	0	0	0
Renewal	3,063	6,125	6,113	8,169	8,219	3,275	3,331	3,388	3,438	3,488
Non-Infrastructure	0	0	0	0	0	0	0	0	0	0
Total Capital Activities	**3,563**	**10,375**	**6,613**	**8,669**	**8,719**	**3,775**	**3,831**	**3,888**	**3,938**	**3,988**
Total Operating Activities	**2,596**	**2,661**	**2,728**	**2,796**	**2,866**	**2,937**	**3,011**	**3,086**	**3,163**	**3,242**

Water asset budget forecasts generally remain steady over the next 10 years. The City does not have any forecasts for service changes or non-infrastructure activities. Total capital activities vary, with significant impacts in year 2023 due to growth (due to the Tollgate Rd East project and the Nick Kaneb Drive Extension – Business Park Expansion), and moderate impacts in years 2023 to 2026 due to increased renewal needs. Projects in these years include the Pitt Street watermain rehabilitation (2023-2024) and the Vincent Massey Drive watermain rehabilitation (2025-2026).

Operating budget forecasts are projected to increase moderately over time, to account for the additional expenses associated with the acquisition of new assets (expansion), as well as the aging of existing assets.

Taxation

Table 7-7: Capital and Maintenance Budget Forecasts – Taxation ($000’s)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Expansion	4,810	8,850	9,250	4,220	6,840	860	5,880	5,900	10,920	10,920
Service Changes	45	30	1,530	30	30	30	30	30	30	30
Renewal	6,925	8,100	8,650	9,663	8,163	6,775	6,963	6,975	7,100	7,150
Non-Infrastructure	0	300	0	0	150	0	0	0	0	0
Total Capital Activities	**11,780**	**17,280**	**19,430**	**13,913**	**15,183**	**7,665**	**12,873**	**12,905**	**18,050**	**18,100**
Total Operating Activities	**6,464**	**6,626**	**6,792**	**6,961**	**7,135**	**7,314**	**7,497**	**7,684**	**7,876**	**8,073**

Taxation asset budget forecasts generally remain steady over the next 10 years. The City has some forecasts for service changes (each year), and non-infrastructure activities (2023 and 2026). Total capital activities vary from $7.6M to $19.4M, depending on the year.

Operating budget forecasts are projected to increase moderately over time, to account for the additional expenses associated with the acquisition of new assets (expansion), as well as the aging of existing assets.

7.5. TOTAL FUNDING SHORTFALL

The City’s total funding shortfall is calculated by comparing the existing budget forecast to the City’s target LOS scenarios completed in the AM analyses. By understanding the difference between existing and target levels, the City can understand the funding shortfall required to meet LOS objectives over the medium and long term.

The results of the scenario analyses and financial plan are illustrated in Figure 7-1 to Figure 7-3. Each figure illustrates the City’s asset needs in a bar graph format. Bars illustrate costs associated with the abovementioned lifecycle activities. The equivalent annual cost of these bars is illustrated as a dashed line, labeled Annual Cost to Meet LOS in 10-Years. The equivalent annual costs of the City’s anticipated budget (solid line) from their financial forecast, as well as other analyzed scenarios (dashed lines) are also plotted to compare and contrast the scenario results. Gaps are visualized by the difference between the City’s anticipated budget (solid line), and the various scenarios (dashed lines).

The AM analyses were conducted under the assumption that operating expenditures will remain the same for all scenarios and are fully accommodated under the City’s existing Operating Budget. Since the lifecycle models were developed around capital works interventions, the forecasting analysis provided a comparison of capital needs (backlog) against anticipated capital funding.

Wastewater

The anticipated funding shortfall, which is determined as the difference between the City's anticipated budget scenario (i.e. the scenario which models the effect on spending under the City's current plan) and the cost to meet the City's LOS targets over the upcoming 10 and 25-year period are summarized in Table 7-8.

Table 7-8: Funding Shortfall (Renewal) – Wastewater

	Meet LOS in 10 Years (Equivalent Annual Cost)	Anticipated Budget Scenario (Equivalent Annual Cost)	10-Year Funding Shortfall/ (Excess)	Meet LOS in 25 Years (Equivalent Annual Cost)	25-Year Funding Shortfall/ (Excess)
Sanitary Linear	$1,024,500	$946,000	$78,500	$870,720	($75,280)
Sanitary Vertical	$0	$0	$0	$0	$0
Combined Linear	$2,914,500	$1,500,000	$1,414,500	$1,112,500	($387,500)
Storm Linear	$400,000	$236,500	$163,500	$303,120	$66,620
Storm Vertical	$11,000	$0	$11,000	$55,680	$55,680
Total Capital Activities	**$4,350,000**	**$2,682,500**	**$1,667,500**	**$2,342,020**	**($340,480)**
Total Operating Activities	**$2,262,023**	**$2,262,023**	**$0**	**$2,262,023**	**$0**

For the wastewater asset group, The City's current funding scenario is closely aligned with the funding required to meet its targets over the 25-year analysis period for renewal needs. This can be seen on the figure below, via the alignment in the solid blue line and dashed orange lines. This indicates that the City is currently projected to meet its LOS targets over the upcoming 25 years. If the City wishes to be more aggressive and meet its targets over a 10-year period (instead of 25-years), which is represented by the dashed black line, then increased funding would be required.

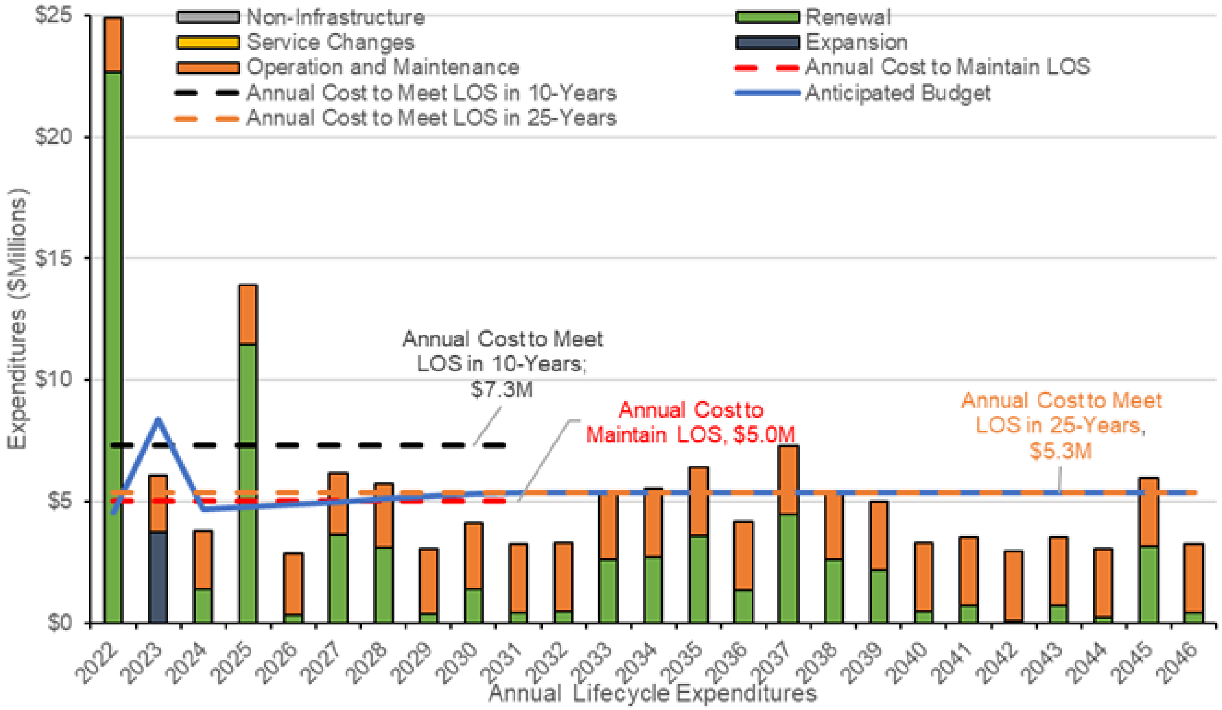

Figure 7-1: Financial Forecast Scenarios Summary – Wastewater

Water

The anticipated funding shortfall, which is determined as the difference between the City's anticipated budget scenario (i.e. the scenario which models the effect on spending under the City's current plan) and the cost to meet the City's LOS targets over the upcoming 10 and 25-year period are summarized in Table 7-9.

Table 7-9: Funding Shortfall (Renewal) – Water

	Meet LOS in 10 Years (Equivalent Annual Cost)	Anticipated Budget Scenario (Equivalent Annual Cost)	10-Year Funding Shortfall/ (Excess)	Meet LOS in 25 Years (Equivalent Annual Cost)	25-Year Funding Shortfall/ (Excess)
Linear	$8,712,000	$4,860,500	$3,851,500	$6,268,900	$1,408,400
Total Capital Activities	**$8,712,000**	**$4,860,500**	**$3,851,500**	**$6,268,900**	**$1,408,400**
Total Operating Activities	**$2,596,109**	**$2,596,109**	**$0**	**$2,596,109**	**$0**

For the water asset group, additional funding would be required in order for the City to meet its LOS targets over the next 10 and 25-years. The solid blue line in the figure below represents the City's anticipated funding. Note that it is lower than the orange dashed-line (required funding to meet targets in 25-years) and the black dashed line (required funding to meet targets in 10-years).

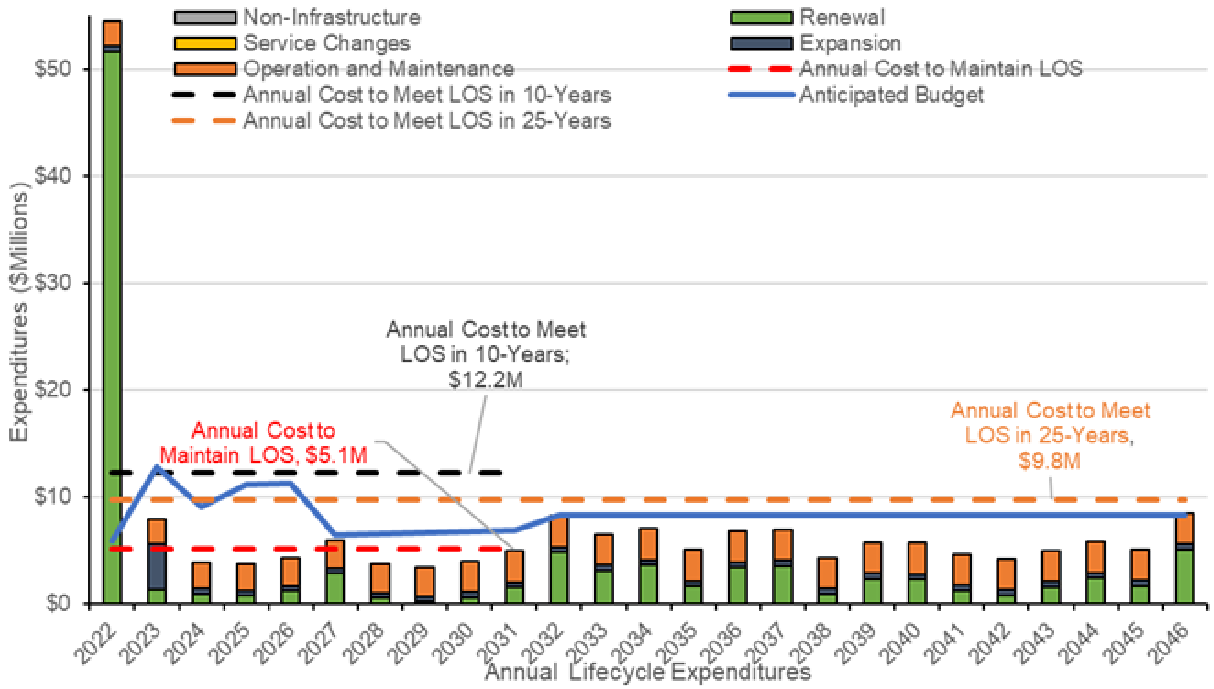

Figure 7-2: Financial Forecast Scenarios Summary – Water

Taxation

The anticipated funding shortfall, which is determined as the difference between the City's anticipated budget scenario (i.e. the scenario which models the effect on spending under the City's current plan) and the cost to meet the City's LOS targets over the upcoming 10 and 25-year period are summarized in Table 7-10.

Table 7-10: Funding Shortfall (Renewal) – Taxation

	Meet LOS in 10 Years (Equivalent Annual Cost)	Anticipated Budget Scenario (Equivalent Annual Cost)	10-Year Funding Shortfall/ (Excess)	Meet LOS in 25 Years (Equivalent Annual Cost)	25-Year Funding Shortfall/ (Excess)
Roads and Small Retaining Walls	$9,558,500	$5,534,500	$4,024,000	$5,985,396	$450,896
Small Culverts	$514,000	$100,000	$414,000	$330,400	$230,400
Traffic Signals and Pedestrian Crossings	$635,000	$410,000	$225,000	$545,840	$135,840
Street Lighting	$106,500	$175,000	($68,500)	$1,540,000	$1,365,000
Municipal Structures	$1,800,000	$685,000	$1,115,000	$1,218,000	$533,000
Sidewalks	$78,669	$291,500	($212,830)	$438,669	$156,967
Recreational Paths	$63,500	$50,000	$13,500	$226,400	$188,160
Total Capital Activities	**$12,756,169**	**$7,246,000**	**$5,510,170**	**$10,306,263**	**$3,060,263**
Total Operating Activities	**$6,464,355**	**$6,464,355**	**$0**	**$6,464,355**	**$0**

For the taxation asset group, The City's current funding scenario is not enough to meet its targets over the 25-year analysis period. The City should consider increasing funding towards these assets over the 10 and 25-year period. The solid blue line in the figure below represents the City's anticipated funding. Note that it is lower than the orange dashed-line (required funding to meet targets in 25-years) and the black dashed line (required funding to meet targets in 10-years).

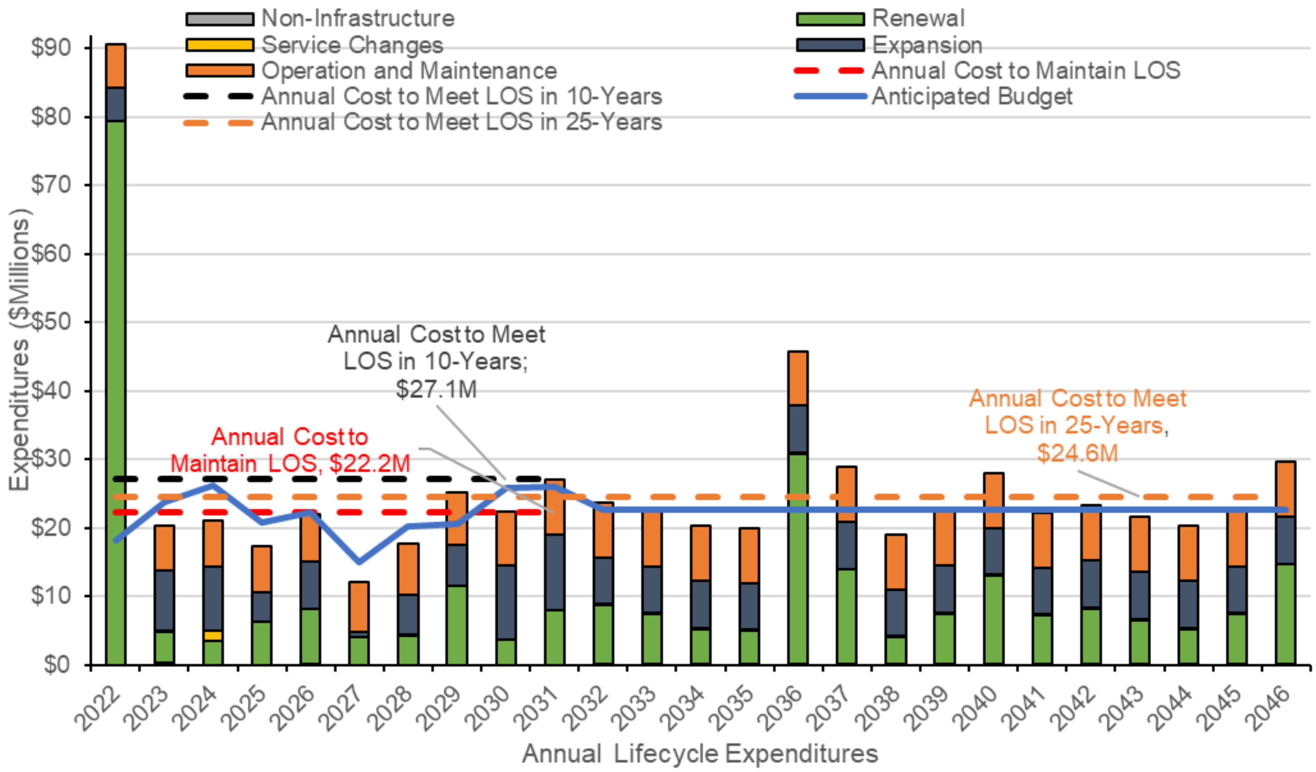

Figure 7-3: Financial Forecast Scenarios Summary – Taxation

Summary

As the City endeavors to address funding shortfalls, it operates in a state where service levels are lower than established targets. During this time, while shortfalls are being addressed, lower service levels (for some assets) could result in premature failures and an overall reduced LOS to the community, which increases the City's overall risk. Furthermore, the City cannot allocate all resources to address gaps immediately, which will result in some work being deferred. Deferrals can also have financial impacts, as they create a situation whereby the City does not have the resources needed to intervene in asset renewals at the most optimal time. This could result in an increase in overall cost, by deferring less costly rehabilitations, which require more costly replacements sooner.

Deferred work may also require emergency intervention to replace assets that have failed. Emergency intervention is often costly, as it requires less planning and additional unforeseen costs to address issues immediately. When assets, such as buried (linear) infrastructure assets are replaced in this way, they are also not able to be coordinated and bundled with other adjacent corridor assets, which means the City cannot take advantage of the cost savings associated with bundled projects.

Furthermore, if infrastructure backlogs are not addressed, an increase in maintenance costs will likely be experienced, as the City will require additional resources and funds to maintain assets that are aged and at a higher risk of failure.

Of note, however, is that the City has made great progress in improving the identified backlog from its past (2016) AMP. This results in improved service levels, which are trending to the positive since the last AMP analyses were completed.

The analysis results from this AMP, with the analysis results from its 2016 AMP are compared in Table 7-11, Table 7-12 and Table 7-13. This illustrates the City's progress over the time period between the development of these two documents.

Table 7-11: Backlog Comparison Between 2022 and 2016 AMP

Assets	2016 Backlog	2022 Backlog
Wastewater/Stormwater (Sanitary, Storm and Combined Sewers) (km)	11.4	13.0
Water (km)	72.1	52.0
Roads (km)	18.4	80.9
Sidewalks (km)	3.5	2.5
Recreational Paths (km)	3.7	0.6
Traffic Signals (ea)	1	42
Street Lights (ea)	858	192

Note that from the abovementioned table, some asset classes have had backlogs increase from the time of the 2016 AMP. These include Wastewater/Stormwater, Roads and Traffic Signals. The reason for this increase is due to a change in the methodologies used to measure backlog that were enacted in this AMP, relative to the methodology that was used in 2016. The City's performance measures from this 2022 AMP and the corresponding levels of service strategy monitor the percentage of assets that are not meeting performance/reliability targets. For its 2016 AMP, the City used an "average condition" targeting methodology, which completed an analysis to maintain the average overall condition of assets at a certain level. The current methodology more closely reflects the City's current decision-making process for replacing assets. This has resulted in a change to the backlog numbers. Furthermore, additional backlog may have been incurred due to the normally anticipated aging of assets that has occurred since the time of the 2016 AMP. Note that for traffic signals, the 2022 backlog values include multiple assets located within intersections (ex. controllers, signals, etc.).

Table 7-12: Investment Rate Comparison Between 2022 and 2016 AMP

	2016 Estimated Replacement Value (2022$)	2016 Yearly Allocation (2022$)	2022 Estimated Replacement Value	2022 Yearly Allocation
Wastewater	$441,900,000	$8,800,000	$637,900,000	$12,758,000
Water	$185,600,000	$3,700,000	$345,900,000	$6,918,000
Taxation	$514,300,000	$10,300,000	$582,000,000	$11,656,000

Note that the 2022 replacement values have increased relative to the 2016 replacement values for all assets. These increases have occurred due to factors including inflation, and an updated analysis of replacement cost data that was used to inform the current (2022) values.

Table 7-13: Reinvestment Rates Using New Approach

	Estimated Replacement Value	2022 Yearly Allocation	Meet LOS in 10-years	Annual Reinvestment Rate
Wastewater	$637,900,000	$12,758,000	$4,350,000	0.70%
Water	$345,900,000	$6,918,000	$8,712,000	2.50%
Taxation	$582,000,000	$11,656,000	$42,728,654	7.30%

In cases where the City is able to meet its needs, or if the City elects to increase funding to achieve service level targets sooner, it should be noted that annual funding allocations should not change. Rather, excess funding should be allocated towards reserves. By maintaining healthy reserves, the City will have the necessary funding in future years where needs are higher, and to aid in tax/rate stabilization in future years.

7.6. FUNDING THE SHORTFALL

The City has several options for addressing funding shortfalls. Financial strategies can be used to maintain or improve service levels.

The first strategy is to increase overall net spending to improve asset performance. For this strategy, there are several options to consider:

1. Modest increases to property taxation as well as water and wastewater rates above-baseline revenue increases to fund the infrastructure funding shortfall.
2. Seek funding from the Provincial or Federal governments to fund infrastructure. The City has been successful in securing grant funding in the past which has supported funding its backlog; however it is not typically provided for renewal of assets. The City is hopeful that its past successes in securing grant funding will continue into the future. In fact, the development of this AMP may have a positive impact in the City's ability to secure additional funding. Although grant funding will be helpful, it should not be relied upon by the City, since it is not guaranteed.
3. Draw from available reserves. A reserve analysis should be completed to identify the impact of this case. Reserves can assist in balancing shortfalls and excesses.
4. Consider debt financing. The City has included anticipated future debt in its long-term financial forecast. Established through its Long-Term Financial Plan, the City practices prudent borrowing. Long-term financing is to be used for only capital projects that involve significant capital dollars (>$2.5M) and have a lifecycle greater than 20 years. Reserve funding based on lifecycle replacement should be considered for funding assets that do not meet this criteria.
5. The City can consider allocating to reserves a minimum percentage (guidelines suggest 1.4%-4%) of the current replacement value of an asset to plan and provide for asset renewal over a lifecycle period.

The second strategy is to adjust asset performance expectations. Funding shortfalls may be reduced by revisiting stakeholder objectives against affordability/willingness to pay. This is particularly applicable to assets such as roads, which have shortfalls in the medium term that subside in the longer term.

A third strategy is to examine the trade-offs between the allocation of current funds between and within asset groups. This practice is generally not enacted by the City and should only be considered if necessary.

7.7. SUMMARY OF RECOMMENDATIONS

The Asset Management analysis completed as part of this AMP has identified shortfalls in funding needs for the City to meet its LOS targets in the long-term. Recommendations for funding strategies for each asset class are provided within the following subsections:

- Subsection 4.2.5 – Sanitary Sewer Collection System
- Subsection 4.3.5 – Combined Sewer Collection System
- Subsection 4.4.6 – Storm Sewer Collection System
- Subsection 4.5.5 – Water Distribution Network
- Subsection 5.2.10 – Road Network
- Subsection 5.3.6 – Active Transportation

A summary of the shortfall is provided in Subsection 7.5. Subsection 7.6 provides recommendations to fund the shortfall.

In addition to these recommendations, the City should endeavor to rebalance funds wherever possible, such as within funding groups (i.e. water, wastewater and taxation) in order to prioritize asset classes with larger backlogs or higher risk. This will assist the City in balancing risk as it continues to address shortfall needs.

8. IMPROVEMENT PLAN

The City's 2022 Core AMP is an integral part of its AM System, which dictates the business practices and processes that make-up Asset Management at the City. An integral part of any AM system is the concept of continual improvement. This is a mechanism, whereby the outputs of the AMP system, including this AMP, provide inputs into the remainder of the components of the system to inform the continued improvement and increased maturity of the overall system.

Throughout the development of this AMP, opportunities for continual improvement have been identified. The following sections summarize these opportunities and provide observations and recommendations to apply continual improvement practices into the strategies that support this AMP. This will advance the maturity of AM at the City, as well as the maturity of future AMPs. This will also assist the City in advancing some of the additional components of this AMP to meet future milestone requirements of O.Reg. 588/17.

The Improvement Plan is divided into sections, following the key content sections that support this AMP. Appropriate AM strategies are that are affected by continual improvement are also referenced. These subsections include:

- General Asset Management
- State of the Infrastructure
- Levels of Service
- Lifecycle Management Strategy
- Financial Strategy

8.1. GENERAL ASSET MANAGEMENT

The City's Asset Management program is well developed and has a level of maturity that ensures that it has the appropriate systems and data in place to meet the requirements of O.Reg. 588/17.

Throughout the course of the development of this AMP, the City has concurrently developed LOS, lifecycle management, and risk management strategies, which have assisted in producing the content of this AMP. These strategies were designed so that they could be standardized and applicable to all asset classes, not just the asset classes featured in this Core AMP.

At the time of writing of this AMP, a maturity assessment of the City's AM system was not available. Maturity assessments aim to understand all components of the City's AM system, and their maturity with respect to international and local standards and best practices. They are often excellent tools to monitor improvement plans, such as this one.

The recommendations for continual improvement – General Asset Management is provided in Table 8-1.

Table 8-1: Improvement Plan Summary Recommendations – General Asset Management

Item	Recommendations
AM-1	▪ Expand the LOS, lifecycle management, and risk management strategies to other asset classes, including non-core assets.
AM-2	▪ Complete an assessment to understand the maturity of the organization's asset management practices. This can be used as a monitoring tool to record continual improvement activities detailed within this improvement plan.
AM-3	▪ Complete climate change analysis to determine the potential effects on infrastructure, and possible strategies to ensure that the City continues to work towards meeting its service level objectives.

8.2. STATE OF THE INFRASTRUCTURE

The City's state of the infrastructure assessment is based on its wealth of asset data, that has been collected and maintained over the years to support asset management.

The recommendations for continual improvement – State of the Infrastructure is provided in Table 8-2.

Table 8-2: Improvement Plan Summary Recommendations – State of the Infrastructure

Item	Recommendations
SI-1	▪ Increase the City's data maturity by collecting additional data to fill gaps, as identified in the City's data gap assessment report (**Appendix A**).
SI-2	▪ Continue to collect and update asset data in line with the City's Data and Condition Assessment Plan (**Appendix B**).
SI-3	▪ Continue to complete condition assessments and collect asset condition data in line with the City's Data and Condition Assessment Plan (**Appendix B**).

8.3. LEVELS OF SERVICE

The City has developed its LOS strategy, in line with the requirements of O.Reg. 588/17. For this 2022 Core AMP, the City does not specify its proposed LOS; however, they will be required to report on proposed LOS to meet the 2025 O.Reg. 588/17 milestone.

The City, within this AMP, provides an analysis on meeting its target LOS, which is a goal that the City has set. Proposed LOS simply detail the LOS that the City plans to provide to the community. The City may be able to meet its targets for some asset classes, in which case these targets will also be the City's proposed LOS. For other asset classes, the City may not be able to achieve its targets, which will result in a proposed LOS that is still below the City's target. The City should be prepared to discuss its proposed LOS for each asset class, as well as the reasons why it intends to propose these LOS in the 2025 AMP.

In order to establish proposed LOS, the City should understand both the internal (organizational) and community objectives and needs with respect to its services.

First, they should record current LOS annually, to develop a historical compendium of LOS information that can be used to understand the effectiveness of each LOS measure in categorizing service objectives, and the responsiveness of this LOS measure to infrastructure investments. Over time, this will allow the City to understand what "target" or "proposed" service level is optimal to ensure that the City can provide the best possible service to the community.

Second, the City should engage the community to communicate its LOS strategy, and solicit feedback on service levels, and infrastructure investments that are tied to those service levels. By doing this, they can understand both the internal and community-based drivers for setting target, or "proposed" LOS.

In addition to developing proposed LOS, the City should also endeavor to continue to collect data to support its LOS strategy and expand on identified future metrics.

The recommendations for continual improvement – Levels of Service is provided in Table 8-3.

Table 8-3: Improvement Plan Summary Recommendations – Levels of Service

Item	Recommendations
LOS-1	▪ Record LOS performance measures annually, to establish a historical compendium of LOS information to assist in refinement and improvement of the LOS strategy over time.
LOS-2	▪ Continue to collect and update data to support future LOS measures that were identified in the City's LOS strategy, for which the City did not have available data to report on in this AMP (i.e. "advanced" or "future" LOS measures).
LOS-3	▪ Review and revise the LOS framework annually to ensure that the LOS framework is up to date and best reflects the City's objectives and strategies.
LOS-4	▪ Establish proposed levels of service, in line O.Reg. 588/17 requirements. Complete internal and community engagement to ensure that proposed LOS align with the needs of the City and community.

8.4. LIFECYCLE MANAGEMENT STRATEGY

The City's lifecycle strategies are based on lifecycle activities and lifecycle models, which mathematically model asset deterioration and common lifecycle interventions. Where possible, the models were based on a review of historical condition data. Many of the models were based on or supported by professional judgment and expertise. Wherever possible, developing models based solely on asset historical condition data is preferable.

The recommendations for continual improvement – Lifecycle Strategy is provided in Table 8-4.

Table 8-4: Improvement Plan Summary Recommendations – Lifecycle Management Strategy

Item	Recommendations
LC-1	▪ Continue to collect asset condition data, and use it to validate existing lifecycle models, modify existing lifecycle models or develop new lifecycle models. ▪ Ensure that appropriate asset data is also collected and tied to the observed condition data, such as asset type, number of past asset interventions/rehabilitations, asset age, etc.
LC-2	▪ Wherever possible, develop lifecycle models based on a review of historical asset data, as opposed to professional judgment.
LC-3	▪ Continue to collect asset intervention costs digitally, and tie them to asset classes, to increase the maturity of forecasting costs.

8.5. FINANCIAL STRATEGY

Part of the process of developing the City's financial strategy was to review historical and forecasted capital budgets and allocate them to specific asset classes so that they can be compared to asset needs forecasts. Often, existing budgets and budget forecasts are not allocated in this manner, and therefore some processing work is required to convert them to the appropriate format.

The recommendations for continual improvement – Financial Strategy is provided in Table 8-5.

Table 8-5: Improvement Plan Summary Recommendations – Financial Strategy

Item	Recommendations
FS-1	▪ When developing the City's 10-year capital plan/forecast, ensure that project amounts are labelled by asset class (as per the City's Asset Hierarchy) and lifecycle activity type. This will simplify the exercise to complete the anticipated budget forecast scenario (i.e. Scenario 1 in this AMP) for future AMPs.